FOREIGN LANGUAGE ACQUISITION AMONG CHILDREN WITH DOWN SYNDROME: A PRECEDENT STUDY FOR CHRISTIAN SCHOOLS

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Doctor of Philosophy

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by

Emily Anne Ibrahim

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APPROVAL SHEET

FOREIGN LANGUAGE ACQUISITION AMONG CHILDREN
WITH DOWN SYNDROME: A PRECEDENT STUDY
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Emily Anne Ibrahim

Read and Approved by:

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Anthony W. Foster (Chair)

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John David Trentham

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Alisha Biler

Date_______________________

For the glory of God

And the flourishing of those he so uniquely formed

with an extra 21st chromosome

In memory of my Daddy

Russell Clay Mathis

February 19, 1955 – January 20, 2022

I kept going because I knew you were cheering me on.

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LIST OF ABBREVIATIONS

ADHD	attention-deficit/hyperactivity disorder
AJMR	*American Journal on Mental Retardation*
AJSLP	*American Journal of Speech-Language Pathology*
ASD	autism spectrum disorder
CA	chronological age
DLD	Developmental Language Disorders
DS	Down syndrome
DSL	Down Syndrome of Louisville
DSRP	*Down Syndrome Research and Practice*
EOWPVT-B	*Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition*
EVCBT	expressive vocabulary content-based test
EVT-2	*Expressive Vocabulary Test, Second Edition*
FL	foreign language
IJLCD	*International Journal of Language & Communication Disorders*
JADD	*Journal of Autism and Developmental Disorders*
JIDR	*Journal of Intellectual Disability Research*
JOCD	*Journal of Communication Disorders*
JSLHR	*Journal of Speech, Language, and Hearing Research*
KBIT-2	*Kaufman Brief Intelligence Test, Second Edition*
L1	first language
L2	second language
MA	mental age
NVC	nonverbal cognition

NVMA	nonverbal mental age
NWRT	nonword repetition task
PPVT-4	*Peabody Picture Vocabulary Test, Fourth Edition*
PSTM	phonological short-term memory
RDD	*Research in Developmental Disabilities*
ROWPVT-B	*Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition*
RVCBT	receptive vocabulary content-based test
TD	typically developing
VSTM	verbal short-term memory

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PREFACE

Nine years ago, I had never had any meaningful interaction with a child with Down syndrome; now I can't imagine my life without them. Nine years ago, I would have never imagined that I would want to pursue doctoral work, but that was because I didn't have a reason to do so. Nine years ago, my life unexpectedly changed when the principal at my new job asked me if I would be willing to teach Spanish to the children with Down syndrome at our little elementary school. As I began to teach those precious children and watch them begin to learn a foreign language, I knew that the world needed to know what I knew: children with Down syndrome can learn a foreign language.

The road to complete this project has been tumultuous and difficult, with many challenges both personally and professionally. I am grateful first and foremost to my God and my Lord, who has sustained me by his grace through many trials. I declare with the psalmist that by my God I have run against many troops, and by my God I have scaled many walls which I thought were insurmountable (Ps 18:29). I would have never begun this research nor carried it to completion without the unwavering support and encouragement of my husband Ayman. You encouraged me in my darkest hours and cheered me at every success. I would have quit a million times over, and likely never would have started, if it weren't for you. You believed in me more than I believed in myself. Thank you.

Before I began this project there were a couple of people who were instrumental in helping to shape me as a teacher, without whose influence I never would have been the type of teacher to successfully teach a foreign language to children with Down syndrome, or any child for that matter. My mother, Rosemary Castillo Mathis,

modeled for me how to teach a second language to children as she taught English as a Second Language during my growing up years. Thank you, Mommy, for coming home and telling me stories of your work and letting me tag along to watch you in action. After I began teaching, Carol Gaab was instrumental in forming my philosophy of language teaching and graciously took me under her wing, for what reason I will never know. After I met her at a conference in Ohio my first year teaching Spanish, my teaching was never the same.

Several scholars have helped me at various stages of this project, and I am thankful that they would take notice of me and guide me in my research. John Grinstead of Ohio State University and Bill VanPatten (diva of SLA) were very helpful to me in the initial stages of my project. Thanks to you both for guiding me and offering your expertise. Moreover, my project would not have succeeded were it not for the guidance and wisdom of Elizabeth Kay-Raining Bird. She graciously met with me via Zoom and corresponded with me from the beginning of my project until the very end, helping me think through issues of methodology, literature, and the challenges of my research, and gave the most detailed feedback on my initial thesis from an outside reader in the history of SBTS. Dr. Kay-Raining Bird, your wisdom, guidance, and feedback were invaluable to this project, and I am grateful that you would invest yourself in me and my research.

I am thankful to have been able to learn at The Southern Baptist Theological Seminary, and for the support that I found there. Dr. Anthony Foster, my doctoral supervisor, was a faithful mentor and help, always ready with a quick, kind, and thorough response. I am grateful to him and to Dr. John David Trentham for their support and flexibility when trials came my way. I am also grateful for the support I found in my cohort mates, especially Becca and Evan Pietsch and Siran Wang. You enriched my learning and helped carry me along the way.

Finally, I am grateful to Down Syndrome of Louisville for welcoming me into their summer camp to conduct my research. Thank you especially to Dr. Jenny Kimes

and Susan Teaford for your help and support in this regard. Additionally, my research would not have been possible were it not for the wonderful teachers at the summer camp who served as my "assistants." They faithfully and cheerfully observed and took notes to help gather data for my case studies and supported the learning of the children at the same time. Nefris, Kelsey, Erin, Samantha, Alex, Lauren, Madeline, Jasmine, Claire, and Hunter, I learned so much from all of you.

Teaching the children at Down Syndrome of Louisville for the completion of this research was one of the greatest honors and joys of my life. I will never forget those six weeks of teaching which began in a whirlwind and ended with tears of sadness because I didn't want my time with the children to end. When I began this project, I knew that they would learn Spanish, yet their learning far exceeded my expectations, and witnessing their growth was magical. But even more than watching them learn Spanish, I loved spending time with them and getting to know them. I am grateful to these precious children for the effort they put forth in class every day when surrounded by an unfamiliar language and am grateful to their parents for entrusting to me their dear children, if only for a short time. My life is forever enriched because of them.

Emily Anne Ibrahim

Louisville, Kentucky

May 2024

CHAPTER 1

RESEARCH CONCERN

"Our students with Down syndrome are included in the classroom and attend all the special area subjects with their classes. However, they have never attended Spanish class before. Would you be willing to have them come to Spanish class?" the principal at my new job asked me. I readily agreed. "We don't really expect them to learn Spanish, per se. We just want them to have a break and do something different with their brains," the program coordinator for students with Down syndrome told me. As the Spanish teacher, I was not sure what to expect from my students with Down syndrome, but I was hopeful that they would learn. Others, however, were not so optimistic. Over a casual conversation at the faculty lunch table, one of the assistants of our students with Down syndrome commented, "I'm not sure why our students are attending Spanish class. They have a hard-enough time with English as it is. It's pretty stupid that we would expect them to learn another language." Despite my colleague's objections, our students began attending Spanish class, though separate from their peers. The students with Down syndrome initially attended Spanish as a group and separate from their peers as the administration was not sure if they would be able to keep up with their typically developing peers in a foreign language class. However, after a year of instruction, I knew they were ready to join their peers, evidenced by the aptitude they displayed to participate in class and acquire the language. The second year, our students with Down syndrome were included in Spanish class with their peers, and by the end of the school year all of them were demonstrating signs of language acquisition, and many of them were on par with their peers.

This story exemplifies the challenges students with Down syndrome (DS) face to be fully included with their peers. Though many may be included in the general classroom, they are often excluded from the foreign language (FL) classroom.[1] Their own teachers may be skeptical toward their ability to learn another language, or even object to the notion that it is wise to expose them to another language. While their classmates reap the benefits of learning another language, they are far too often denied the opportunity of inclusion in the FL classroom.

Introduction to the Research Problem

The official push for inclusion of students with disabilities into the mainstream classroom in the United States began in 1975 with the passing of the Education for Handicapped Children Act (EHA).[2] Among other mandates, the act specified that, "to the maximum extent appropriate, children with disabilities . . . [be] educated with children who are not disabled," and that they be removed from the "regular educational environment . . . only when the nature or severity of the disability is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily."[3] The change in the educational scene in the United States was not

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[1] Studies conducted by an international group of researchers in various locations throughout Europe, Canada, and the United States (New Mexico) demonstrate that students with developmental disabilities, including children with Down syndrome, have limited access to programs which support bilingualism or second language learning in the school setting. Stefka H. Marinova-Todd et al., "Professional Practices and Opinions about Services Available to Bilingual Children with Developmental Disabilities: An International Study," *JOCD* 63 (2016): 58; Julia Scherba de Valenzuela et al., "Access to Opportunities for Bilingualism for Individuals with Developmental Disabilities: Key Informant Interviews," *JOCD* 63 (2016): 32–46.

[2] In 1990 the EHA was revised and renamed the Individuals with Disabilities Education Act (IDEA). *Individuals with Disabilities Education Act*, Public Law 101–476, *U.S. Statutes at Large* 104 (1990): 1103–51. After further revisions, the act was again revised and renamed the Individuals with Disabilities Education Improvement Act (IDEIA) in 2004. *Individuals with Disabilities Education Improvement Act*, Public Law 108–446, *U.S. Statutes at Large* 118 (2004): 2647–808. The EHA called for the integration (mainstreaming) of children with disabilities, while the term and concept "inclusion" did not begin to be widely used until the adoption of IDEA in 1990. Turki Alquraini and Diane Gut, "Critical Components of Successful Inclusion of Students with Severe Disabilities: Literature Review," *International Journal of Special Education* 27, no. 1 (2012): 44–45.

[3] *Education for All Handicapped Children Act*, Public Law 94–142, *U.S. Statutes at Large* 89

immediate, but rather students with disabilities were gradually integrated into the mainstream classroom.[4] By 2018 "more than 64% of children with disabilities" in the United States "(were) in general education classrooms 80% or more of their school day."[5] The increase in students with disabilities learning alongside their peers in the mainstream classroom is likely due to further mandates and governmental stipulations as well as an increase of identification of students with mild disabilities.[6] However, the percentage of students with intellectual disabilities included in the general education classroom is considerably lower than that of students with learning disabilities or other disabilities.[7]

Christian schools have an even greater impetus for educating and including children with disabilities, far more compelling than that of any governmental mandate: the inherent value and dignity of every person created in the image and likeness of God. Among other things, the doctrine of *imago Dei* signifies each person's "uniqueness" and "dignity before God," and thus should compel Christian schools to make education

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(1975): sec. 1412(5)(B), 780.

[4] James McLeskey et al., "Are We Moving toward Educating Students with Disabilities in Less Restrictive Settings?," *Journal of Special Education* 20, no. 10 (July 2010): 1–2.

[5] U.S. Department of Education, "History of the IDEA," accessed November 28, 2020, https://sites.ed.gov/idea/about-idea/#IDEA-History.

[6] McLeskey et al., "Educating Students with Disabilities in Less Restrictive Settings?," 6–7. McLeskey identifies the federal IDEA of 1997 and 2004, the No Child Left Behind Act of 2002, and further stipulations by the Office of Special Education Programs in 2004 as "(catalysts) for many states and local school districts to educate increasing numbers of students with disabilities in (general education) classroom" (7).

[7] McLeskey et al., "Educating Students with Disabilities in Less Restrictive Settings?," 7; Dianne L. Ferguson, "International Trends in Inclusive Education: The Continuing Challenge to Teach Each One and Everyone," *European Journal of Special Needs Education* 23, no. 2 (2008): 111. In 2017, while 63.5 percent of all students with disabilities spent 80 percent or more of their day in the general classroom, only 17 percent of students with intellectual disabilities did so. U.S. Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs, *41st Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act, 2019* (Washington, DC, 2020), 55. Individuals with Down syndrome have significant cognitive (intellectual) disabilities, as well as "specific deficits in speech, language production, and auditory short-term memory." Robin S. Chapman and Linda J. Hesketh, "Behavioral Phenotype of Individuals with Down Syndrome," *Mental Retardation & Developmental Disabilities Research Reviews* 6, no. 2 (2000): 84.

available to all people, for each person, no matter their status or abilities, is worthy of an education.[8] Despite this great impetus, the state of inclusive education or even segregated education of children with disabilities in Christian schools seems to lag far behind that of public education. Since Christian schools are not required by law to provide services for children with disabilities, little data is available on what percentage of Christian schools educate students with special needs, or what percentage of the student population of said schools have learning or intellectual disabilities.[9]

However, a couple of key studies shed some light on the state of education of students with special needs in Christian schools in the past couple of decades.[10] Research conducted by the United States Conference of Catholic Bishops in 2002 found that 7 percent of children attending Catholic schools have disabilities, as compared to more than 11 percent in public schools.[11] Among evangelical schools, a survey conducted by the Association of Christian Schools International found that approximately 35 percent of schools provide some sort of special education service, with 7 percent of students enrolled in said special education programs.[12] Of those schools which reported providing

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[8] Peter J. Gentry and Stephen J. Wellum, *Kingdom through Covenant: A Biblical-Theological Understanding of the Covenants*, 2nd ed. (Wheaton, IL: Crossway, 2018), 669.

[9] Tammy Bachrach, "Venturing outside the Bounds of IDEIA in Search of Inclusive Christian Education: An Autoethnographic Account," *Journal of Research on Christian Education* 30, no. 1 (2021): 5. For an explanation of the relationship between IDEA, Christian schools, and special education services provided by public schools, see Julie M. Lane and Quentin P. Kinnison, *Welcoming Children with Special Needs: Empowering Christian Special Education through Purpose, Policies, and Procedures*, ed. David R Jones (Bloomington, IN: West Bow Press, 2021), 36–48.

[10] I use the term Christian here broadly, and it encompasses any school that would claim the identification "Christian," whether Catholic or Protestant/Evangelical.

[11] United States Conference of Catholic Bishops, *Catholic School Children with Disabilities* (Washington, DC: United States Conference of Catholic Bishops, 2002), cited in Bachrach, "Venturing outside the Bounds of IDEIA," 5, and Leonard DeFiore, "The State of Special Education in Catholic Schools," *Journal of Catholic Education* 9, no. 4 (2006): 459.

[12] In some areas the numbers may be higher. For example, in his survey of faith-based schools in ten rural counties of a midwestern state, Eigenbrood found that 83 percent of the schools surveyed provided resource room services, though the majority of the students using the services "had not been

special education services, 31 percent reported providing inclusive classrooms, yet 40 percent of schools reported having students whose special education needs are not met by the services provided.[13] Furthermore, special education services in Christian schools are generally restricted to students with mild learning disabilities such as dyslexia, attention-deficit/hyperactivity disorder, or Asperger's syndrome.[14] Students with multiple or moderate to severe disabilities such as intellectual disabilities or behavioral difficulties, like children with DS, are often excluded from Christian schools.[15]

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officially identified as eligible for special education services." Additionally, Eigenbrood reports that "faith-based schools . . . made less use of special education services than public schools." Rick Eigenbrood, "A Survey Comparing Special Education Services for Students with Disabilities in Rural Faith-Based and Public School Settings," *Remedial and Special Education* 26, no. 1 (2005): 20. Similarly, in their survey of 240 Christian schools in the United States, Lane and Jones found that 93 percent "knowingly accept students with disabilities." Julie M. Lane and David R. Jones, "Special Education Professional Development in Christian Schools," *Journal of the Christian Institute on Disability* 3, no. 2 (2014): 50. However, this does not mean that they are currently serving students with disabilities nor that they provide adequate services for those students.

[13] Charlotte A. Marshall, "By the Numbers: How Christian Schools Serve Students with Special Needs," Association of Christian Schools International, March 3, 2020, https://blog.acsi.org/how-christian-schools-serve-students-with-special-needs.

[14] Jennifer Camota Contreras, "Including Exceptional Children in a Christian Learning Community: New Narratives in Special Education" (EdD diss., The University of San Francisco, 2013), 45–46, 56; Martin Scanlan and Karen Tichy, "How Do Private Sector Schools Serve the Public Good by Fostering Inclusive Service Delivery Models?," *Theory into Practice* 53, no. 2 (2014): 152; Joan Kent Bacon and Kelsey Elizabeth Erickson, "Special Education in Lutheran Schools," *Journal of Religion, Disability & Health* 14, no. 4 (2010): 361; Lane and Jones, "Special Education Professional Development," 55. Eigenbrood's survery, which revealed a high percentage of faith-based schools providing special education services, demonstrated that these schools provided support for students with mild disabilities, most of whom did not have an IEP and had not been officially diagnosed with a disability. Eigenbrood, "A Survey Comparing Special Education Services," 20–21. Lane and Jones note that "the discrepancy between the number of students with Asperger's syndrome served and the number of students with autism served may indicate misunderstanding of how these two disability types are related." Lane and Jones, "Special Education Professional Development," 55. Even so, it may also reflect the trend that Christian schools are less likely to admit a child with a more severe form of autism.

[15] DeFiore, "The State of Special Education," 459; Meghan M. Burke and Megan M. Griffin, "Students with Developmental Disabilities in Catholic Schools: Examples in Primary and Secondary Settings," *Journal of Catholic Education* 19, no. 3 (2016): 214. I should note that I do personally know of two Christian schools (one Catholic and one evangelical) in my own city (Louisville, Kentucky) which specifically serve children with DS in an integrated context. However, this does not seem to be a common trend among Christian schools. In her research on special education in Christian schools, Contreras provides examples of a variety of education models for children with special education needs in Christian schools, including children with severe disabilities, though the most common seems to be those schools

Internationally, inclusion has become a hot topic over the past few decades. Beginning with the Salamanca Statement in 1994, international organizations, national governments, local governments, and school districts have advocated for the inclusion of children with special needs or disabilities in the mainstream classroom.[16] Thanks in part to these efforts, the inclusion of students with DS in the mainstream classroom around the world has increased considerably since the release of the Salamanca Statement.[17] Benefits of inclusion for children with DS are many, including academic, social, and communicative.[18]

While inclusion of children with DS has advanced in the general classroom, the same cannot be said for the FL classroom; opportunities for children with DS to learn a second language are nearly non-existent in the school setting. Though in theory children with DS have equal access to opportunities to attain or maintain bilingualism, this is often

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which provide services for children with mild learning disabilities. Contreras, "Including Exceptional Children."

[16] Thomas Hehir et al., *A Summary of the Evidence on Inclusive Education* (Cambridge, MA: Abt Associates, 2016), 4–6; UNESCO, *The Salamanca Statement and Framework for Action on Special Needs Education* (adopted by the World Conference on Special Needs Education: Access and Quality, Salamanca, Spain, June 1994). The Salamanca Statement was the first international statement of its kind to essentially make it "quasi-obligatory for national delegations to implement the objectives" of inclusive education. Florian Kiuppis and Rune Sarromaa Hausstätter, "Inclusive Education for All, and Especially for Some? On Different Interpretations of Who and What the 'Salamanca Process' Concerns," in *Inclusive Education Twenty Years after Salamanca*, ed. Florian Kiuppis and Rune Sarromaa Hausstätter, Disability Studies in Education 19 (New York: Peter Lang, 2015), 1.

[17] While no current data is available, the following reports attest to the increase: Liv Inger Engevik, K-A. B. Næss, and L. Berntsen, "Quality of Inclusion and Related Predictors: Teachers' Reports of Educational Provisions Offered to Students with Down Syndrome," *Scandinavian Journal of Educational Research* 62, no. 1 (2018): 34–51, demonstrates that inclusion of children with DS into the mainstream classroom in Norway is higher than originally thought, though there remains much room for improvement. See also Sam Fox, Peter Ferrell, and Pauline Davis, "Factors Associated with the Effective Inclusion of Primary-Aged Pupils with Down's Syndrome," *British Journal of Special Education* 31, no. 4 (2004): 184; Robert M. Hodapp, "Families of Persons with Down Syndrome: New Perspectives, Findings, and Research and Service Needs," *Mental Retardation & Developmental Disabilities Research Reviews* 13, no. 3 (August 2007): 280.

[18] Hehir et al., *A Summary of the Evidence*, 2; Alquraini and Gut, "Critical Components of Successful Inclusion," 46.

not the case in practice.[19] Despite teachers' and administrators' somewhat positive attitude toward the ability of students with mild developmental disabilities to learn a second language, students with developmental disabilities are not included in the second language classroom at the same rate as their typically developing (TD) peers. Even when schools have an inclusive philosophy or express the desire to include students with developmental disabilities, children with developmental disabilities do not have equal access to learning or maintaining a second language.[20] Reasons for exclusion for second language learning include the nature of one's disability, priority given to special needs, IEPs, scheduling conflict, service availability, and parental decisions.[21] When a conflict exists between participating in special education services or participating in the second language learning context, priority is often given to special education services. Overall, priority seems to be given to special needs, often driven by the belief either by parents or professionals that severe learning, language, or intellectual disabilities may impede students from learning a second language, or that attempting to do so would add an unnecessary burden on the child.[22] The fact that some parents of children with developmental disabilities are counseled not to allow their child to participate in programs that facilitate learning a second language seems to reflect the misconception that individuals with DS or other disabilities are unable to learn a second language, or at least that it is harmful to their development.[23]

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[19] Diane Pesco et al., "A Multi-Site Review of Policies Affecting Opportunities for Children with Developmental Disabilities to Become Bilingual," *JOCD* 63 (2016): 15–31; de Valenzuela et al., "Access to Opportunities," 32–46.

[20] de Valenzuela et al., "Access to Opportunities," 37.

[21] de Valenzuela et al., "Access to Opportunities," 32–46.

[22] de Valenzuela et al., "Access to Opportunities," 38–40.

[23] Fred Genesee, "French Immersion and At-Risk Students: A Review of Research Evidence," *Canadian Modern Language Review* 63, no. 5 (2007): 656. See also Elizabeth Kay-Raining Bird et al., "The Language Abilities of Bilingual Children with Down Syndrome," *AJSLP* 14, no. 3 (2005):

However, research over the past two and a half decades has made clear that individuals with DS are capable of becoming bilingual.[24] In addition, neither bilingualism nor exposure to a second language have been found to be harmful to children with DS.[25] Bilingualism has been shown to offer many benefits to the general population, such as enhanced attention and cognitive control, working memory, and executive function.[26] Even limited contact with a second language may prove to offer metalinguistic benefits to children learning to read.[27] Moreover, there is evidence that bilingualism is beneficial for children with DS. For example, bilingual children with DS were shown to have a larger overall vocabulary than monolingual children with DS.[28] Additionally, learning a second

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197. Kay-Raining Bird and colleagues state that "there seems to be a continued need to disseminate current evidence broadly so that professionals and parents are able to make informed decisions and recommendations and children with DD are included in important life contexts." Elizabeth Kay-Raining Bird, Fred Genesee, and Ludo Verhoeven, "Bilingualism in Children with Developmental Disorders: A Narrative Review," *JOCD*, Article in Press (2016): 11. See also Elizabeth Kay-Raining Bird et al., "Access and Outcomes of Children with Special Education Needs in Early French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 21; Jean Ware, Catrin Bethan Lye, and Fliss Kyffin, "Bilingualism and Students (Learners) with Intellectual Disability: A Review," *Journal of Policy and Practice in Intellectual Disabilities* 12, no. 3 (2015): 226–27.

[24] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in *Multilingual Perspectives on Child Language Disorders*, ed. Janet L. Patterson and Barbara L. Rodriguez (Bristol, UK: Channel View, 2015), 53–54.

[25] Jamie O. Edgin et al., "Neuropsychological Effects of Second Language Exposure in Down Syndrome," *JIDR* 55, no. 3 (2011): 351–56; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 187–99; Patricia L. Cleave et al., "Syntactic Bootstrapping in Children with Down Syndrome: The Impact of Bilingualism," *JOCD* 49 (2014): 51.

[26] Ellen Bialystok, "Consequences of Bilingualism for Cognitive Development," in *Handbook of Bilingualism: Psycholinguistic Approaches*, ed. Judith F. Kroll and Annette M. B. De Groot (Oxford: Oxford University Press, 2005), 417–32; Olusola O. Adesope et al., "A Systematic Review and Meta-Analysis of the Cognitive Correlates of Bilingualism," *Review of Educational Research* 80, no. 2 (2010): 207–45.

[27] Gregory W. Yelland, Jacinta Pollard, and Anthony Mercuri, "The Metalinguistic Benefits of Limited Contact with a Second Language," *Applied Psycholinguistics* 14, no. 4 (1993): 423–44; Ruth Campbell and Efisia Sais, "Accelerated Metalinguistic (Phonological) Awareness in Bilingual Children," *British Journal of Developmental Psychology* 13, no. 1 (1995): 61–68; Maggie Bruck and Fred Genesee, "Phonological Awareness in Young Second Language Learners," *Journal of Child Language* 22, no. 2 (1995): 307–24.

[28] Krista Feltmate and Elizabeth Kay-Raining Bird, "Language Learning in Four Bilingual

language may also confer social benefits to children with DS as it may increase their abilities to communicate with others in their community and may open future opportunities for employment and recreation, thus "(increasing) social inclusion and (decreasing) social isolation."[29] Despite the evidence, students with DS are regularly denied the opportunity to participate in the FL classroom and reap the benefits of both inclusion and bilingualism.

Need for the Study

While bilingualism in individuals with DS is still an understudied topic, second language acquisition in the context of the FL classroom, with children having minimal exposure to the language, is virtually non-existent. Pioneer researcher in bilingualism in children with DS, Elizabeth Kay-Raining Bird, asks, "Can individuals with Down syndrome become second language learners? The answer is probably. There are currently no studies of bilingualism in children with DS that have focused specifically upon second language learners. This is an important gap in the literature."[30] This research seeks to be a

Children with Down Syndrome: A Detailed Analysis of Vocabulary and Morphosyntax," *Canadian Journal of Speech-Language Pathology and Audiology* 32, no. 1 (2008): 16.

[29] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 57–58. This would be especially true for children growing up in a bilingual home or community but may prove true for children with DS in the FL context as well, especially given the increased globalization and mixture of cultures. Sarah Martin and colleagues report the case of Jake, a boy with DS who participated in French Immersion and as a result began to use his French to communicate with others in his community. Sarah Martin et al., "Bilingual Outcomes for a Student with Down Syndrome in French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 19–20. See also Julie Longard and Hélène Deacon, "Bilingualism in Children with Down Syndrome," *Literacy Today* (June 2009): 30.

[30] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," *Perspectives on Language Learning and Education* 16, no. 3 (2009): 93. While one study has since been conducted on second language learning in the immersion context, I am not aware of any significant scholarly research which has been conducted on the topic of second language learning in the foreign language classroom among children with DS since the publication of the quoted article. It should be noted that in 2017 an EdD dissertation was published on the topic of receptive vocabulary acquisition in the FL context, but was very limited in scope, focusing on the effects of music in learning targeted vocabulary, and was a case study of one child. Roberto Olmeda Casanova, "The Effect of Using Music as a Socio-Affective Strategy to Teach English to a Second Grade Down Syndrome Student" (EdD diss., University of Puerto

first step in filling that gap.

Though some work has been done in the area of second language acquisition in the context of the FL classroom for children with Developmental Language Disorders (DLD) and learning disabilities more generally, this work is still extremely sparse, and the need remains for further research.[31] Furthermore, even that research which focuses on second language acquisition in the FL classroom in students with DLD examines acquisition in form-based teaching, in which grammar is explicitly explained and practiced.[32] Research is needed to assess language acquisition with different types of instruction, such as that which is communicative and meaning-based, not form-based.[33]

Rico, 2012). For the case study on second language learning by a child with DS in the immersion context, see Martin et al., "Bilingual Outcomes," 1–29. While Edgin and colleagues conducted a study on the neuropsychological effects of second language exposure upon children with DS, they did not collect data regarding linguistic competence in each language. Edgin et al., "Neuropsychological Effects," 355. Additionally, the exposure to the second language was primarily through parents or caregivers in the home, not in the FL or instructional context (352).

[31] Elena Tribushinina, Elena Dubinkina-Elgart, and Nadezhda Rabkina, "Can Children with DLD Acquire a Second Language in a Foreign-Language Classroom? Effects of Age and Cross-Language Relationships," *JOCD* 88 (2020): 14; Mary Caitlin S. Wight, "Students with Learning Disabilities in the Foreign Language Learning Environment and the Practice of Exemption," *Foreign Language Annals* 48, no. 1 (2015): 50; Peggy McCardle and Erika Hoff, "An Agenda for Research on Childhood Bilingualism," in *Childhood Bilingualism: Research on Infancy through School Age*, ed. Peggy McCardle and Erika Hoff, Child Language and Child Development 7 (Bristol, UK: Multilingual Matters, 2006), 158–61. The literature of second language acquisition in the context of the FL classroom among various special needs populations will be reviewed in chapter 2.

[32] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 5; Inge Zoutenbier and Rob Zwitserlood, "Exploring the Relationship between Native Language Skills and Foreign Language Learning in Children with Developmental Language Disorders," *Clinical Linguistics & Phonetics* (February 2019): 1–13. It is not clear what type of teaching was utilized in the Zoutenbier and Zwitserlood study, but the assessment for language acquisition was largely dependent upon reading, possibly creating a disadvantage for the students with DLD to demonstrate their acquisition.

[33] Form-based teaching "(explicitly) . . . (focuses) on the formal properties (of language) with either little or no attention to meaning." Bill VanPatten and Alessandro G. Benati, *Key Terms in Second Language Acquisition*, 2nd ed. (London: Bloomsbury, 2015), 117. As opposed to form-based teaching, communicative language teaching has as its goal "communicative competence and . . . seeks to make meaningful communication and language use a focus of all classroom activities." Jack C. Richards and Richard W. Schmidt, *Longman Dictionary of Language Teaching and Applied Linguistics*, 4th ed. (London: Pearson, 2013), 99.

Finally, the need exists not only to explore the acquisition of a second language by students with DS, but to provide for teachers an example of how to effectively include children with DS in the FL classroom.[34] True inclusion begins with teachers, and unless FL teachers have a viable example of inclusion and understanding of the capabilities of students with DS to acquire a second language, many may not be willing or able to effectively include students with DS in their classroom.[35] By documenting the acquisition of a second language by children with DS, this study seeks to "[enlarge] the capacity" of FL teachers to "imagine what [may] be achieved" by students with DS in relation to second language acquisition and thus increase their "sense of accountability for bringing it about."[36] By providing am example of how to include children with DS in the FL classroom, this study also seeks empower the FL teacher's imagination to bring about this achievement of second language acquisition in children with DS.[37]

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[34] Longard and Deacon note that in order for students with DS to be successful in L2 learning, teachers must "have access to appropriate resources to support children with special needs, and to date there are few available." Longard and Deacon, "Bilingualism in Children with Down Syndrome," 30. See also Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 11.

[35] Arnett and Mady document the attitudes of novice FL teachers regarding inclusion of students with learning disabilities. Katy Arnett and Callie Mady, "Exemption and Exclusion from French Second Language Programs in Canada: Consideration of Novice Teachers' Rationales," *Exceptionality Education International* 28, no. 1 (2018): 86–99. Though teachers' attitudes vary, they are largely positive toward the idea of including students with learning disabilities. However, all four teachers felt that some students may not be suitable for FL learning, and Arnett and Mady note that "French is typically the only subject in which students are removed from a learning environment because of challenges" (96). When challenges arise in other subjects, needed support is typically provided. Two teachers admitted that teaching methods may largely affect the success of students with learning disabilities (95).

[36] Mel Ainslow, "Struggling for Equity in Education: The Legacy of Salamanca," in Kiuppis and Hausstätter, *Inclusive Education Twenty Years after Salamanca*, 43.

[37] Paradis also emphasizes the need to get the word out to FL teachers that children with developmental disabilities are indeed able to learn an L2, yet also stresses the need for further research in this area. Johanne Paradis, "An Agenda for Knowledge-Oriented Research on Bilingualism in Children with Developmental Disorders," *JOCD* 63 (2016): 80.

The Benefit of the Study

1. This study may benefit teachers in the FL classroom who would like to integrate students with disabilities such as those with DS into their classroom but do not know if or how it is possible.

2. This study may benefit parents who may want to allow their child with DS to participate in the FL classroom but do not know if their child could be successfully included or successfully learn the language.

3. This study may benefit school administrators who are seeking a more fully inclusive approach.

4. This study may benefit individuals with DS cognitively and socially through exposure to a second language.

5. This study may benefit individuals with other learning or intellectual disabilities who are often excluded from the FL classroom for many of the same reasons as those individuals with DS.

Research Problem

Some parents may desire for their child with DS to learn a second language, but they are not sure if it is possible.[38] Can students with DS acquire a second language in the context of the FL classroom? If so, will they be able to keep up with their peers? What about children with DS and a dual diagnosis of autism spectrum disorder? Can children with multiple severe disabilities successfully participate in the FL classroom? Many language teachers are eager to include students with disabilities in their classroom but are unsure how to do so. What type of curriculum is effective for students with DS to learn a second language? How should the teacher modify or adjust the curriculum for students with DS? What type of support do students with DS in the FL classroom need? What is the proper role of the assistant? This study will provide FL teachers an example of teaching individuals with DS in the FL classroom and will describe the initial stages of language acquisition of a second language of individuals with DS with and without a comorbid diagnosis of autism spectrum disorder.

[38] See, for example, the opinions expressed by parents of children with special educational needs in Kay-Raining Bird et al., "Access and Outcomes," 21–22.

Purpose Statement

The purpose of this study was to describe the participation of elementary-aged children with Down syndrome with and without a comorbid diagnosis of ASD in a six-week foreign language class and to measure the receptive and expressive lexical acquisition of Spanish as a foreign language in students with Down syndrome.

Research Questions

The research questions explored two major categories: participation of students with Down syndrome in the foreign language classroom and the initial stages of second language acquisition in children with Down syndrome.

1. How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?
    a. How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?
    b. How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?
    c. What barriers exist to their participation in the foreign language classroom?
    d. What type of support do children with Down syndrome need to successfully participate in the foreign language classroom?
    e. What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?
2. To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?
    a. How does the acquisition of second language vocabulary in a six-week foreign language classroom of children with a dual diagnosis of ASD differ from that of their peers with DS only?
3. Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?
4. Which select variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome?

5. Do L1 vocabulary levels of children with Down syndrome change over the course of a six-week FL class as measured by a standardized assessment?

Research Population and Sample

The research population for this study was monolingual children with DS, with and without a comorbid diagnosis of ASD. All students in this study were monolingual English-speaking children who had completed kindergarten–sixth grade. The research sample of children with DS was recruited primarily through Down Syndrome of Louisville, and was not drawn from one school, but from all over the greater Louisville metro area. All research sample children were participants in a six-week summer academic enrichment camp at Down Syndrome of Louisville. Participants in the research sample did not have any significant prior exposure to the Spanish language nor were they enrolled in any other type of Spanish language learning class for the duration of the study.[39] Additionally, children with and without DS participated in a pilot test group, and monolingual children with DS formed a first language (L1) control group.

Research Delimitations

This study assessed the receptive and expressive lexical acquisition of children with DS with and without a comorbid diagnosis of ASD resulting from participation in a six-week FL class. The focus of this study was lexical acquisition, as measurement of vocabulary is a meaningful assessment of language acquisition.[40] Moreover, even more

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[39] One child had previously participated in a Spanish class but did not appear to have retained any vocabulary from that class.

[40] Batia Laufer and Zahava Goldstein note that "tests of vocabulary size have been shown to predict success in reading, writing, and general language proficiency as well as academic achievement." Batia Laufer and Zahava Goldstein, "Testing Vocabulary Knowledge: Size, Strength, and Computer Adaptiveness," *Language Learning* 54, no. 3 (2004): 401–2. See also Beatriz González-Fernández and Norbert Schmitt, "Vocabulary Acquisition," in *The Routledge Handbook of Instructed Second Language Acquisition*, ed. Shawn Loewen and Masatoshi Sato, Routledge Handbooks in Applied Linguistics (New York: Routledge, 2017), 280. J. Charles Alderson contends that vocabulary is a useful measure of language proficiency, especially a knowledge of low-frequency words. J. Charles Alderson, "Judging the Frequency of English Words," *Applied Linguistics* 28, no. 3 (2007): 384. For the necessity of vocabulary for reading in

so than in typically developing individuals, vocabulary development may be an important precursor for syntactic development in individuals with intellectual disability such as DS, thus measuring vocabulary development is a reasonable first step to measuring initial language acquisition.[41] Given the limited exposure that students were to have to the second language during the study, it was speculated that vocabulary production would likely be minimal, and certainly less than vocabulary comprehension.[42] Though some may have deemed that it was thus not worth measuring expressive vocabulary, since this study was the first of its kind and children with DS currently have limited access to participation in the FL classroom, it was decided to be advantageous to use this opportunity to measure participants' expressive, as well as receptive, vocabulary acquisition.[43] Assessing both the receptive and expressive lexical acquisition of

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L2, see Batia Laufer, "The Lexical Plight in Second Language Reading: Words You Don't Know, Words You Think You Know, and Words You Can't Guess," in *Second Language Vocabulary Acquisition: A Rationale for Pedagogy*, ed. James Coady and Thomas Huckin (Cambridge: Cambridge University Press, 1997), 20–34. For vocabulary and academic achievement, see Muriel Saville-Troike, "What Really Matters in Second Language Learning for Academic Achievement?," *TESOL Quarterly* 18, no. 2 (1984): 199–219.

[41] Monica Cuskelly, Jenny Povey, and Anne Jobling, "Trajectories of Development of Receptive Vocabulary in Individuals with Down Syndrome," *Journal of Policy and Practice in Intellectual Disabilities* 13, no. 2 (2016): 111; Margje van der Schuit et al., "How Cognitive Factors Affect Language Development in Children with Intellectual Disabilities," *RDD* 32, no. 5 (2011): 1884–94. That is, it seems that in order for second language syntax to develop, second language vocabulary development must first occur. Thus, it is reasonable in measuring incipient stages of second language acquisition to measure only vocabulary.

[42] Before the start of the study, it was suspected that the participants with DS may not be able to produce any significantly measurable amount of language after such limited contact with the language. Sharon Unsworth et al., "An Investigation of Factors Affecting Early Foreign Language Learning in the Netherlands," *Applied Linguistics* 36, no. 5 (2015): 532. See also Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 6.

[43] Per a Zoom conversation with Elizabeth Kay-Raining Bird, leading scholar in bilingualism in individuals with DS, on February 1, 2021. Additionally, Sini Smolander and colleagues note that previous studies investing L2 acquisition in children with DLD have largely neglected to investigate vocabulary acquisition, and "have rarely included both receptive and expressive modes." Sini Smolander et al., "L2 Vocabulary Acquisition of Early Sequentially Bilingual Children with TD and DLD Affected Differently by Exposure and Age of Onset," *IJLCD* 56, no. 1 (2021): 76. Thus, despite the limitations, the need exists to study both receptive and expressive vocabulary acquisition.

participants presents a fuller picture of their acquisition and fluency (or lack thereof). This study did not assess reading abilities or writing abilities in Spanish. In addition, this study did not assess grammatical acquisition.[44] Since exposure to the L2 was severely limited and individuals with DS are shown to have marked deficits in grammatical receptivity and expression, as well as difficulties in literacy skills, a longer intervention would be more effective to study grammar acquisition as well as reading and writing abilities.[45]

Terminology[46]

Autism spectrum disorder. Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by persistent deficits in social interaction and communication and restricted and repetitive behaviors, interests, or activities, present from early development. Though the severity of symptoms varies widely, ASD impairs

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[44] By *grammatical* I am referring to the "syntactic and morphological properties of a language." Heike Behrens, "Grammatical Categories," in *The Cambridge Handbook of Child Language*, ed. Edith L. Bavin (Cambridge: Cambridge University Press, 2009), 200.

[45] In her review of the research, Alexandra Perovic concludes that the impaired linguistic abilities of individuals with DS "usually mean impaired grammar." Alexandra Perovic, "Syntactic Deficit in Down Syndrome: More Evidence for the Modular Organisation of Language," *Lingua* 116, no. 10 (2006): 1619. See also Leonard Abbeduto et al., "The Linguistic and Cognitive Profile of Down Syndrome: Evidence from a Comparison with Fragile X Syndrome," *DSRP* 7, no. 1 (2001): 11, 13; M. Koizumi, Y. Saito, and M. Kojima, "Syntactic Development in Children with Intellectual Disabilities–Using Structured Assessment of Syntax," *JIDR* 63, no. 12 (2019): 1438. For literacy skills see Kari-Anne B. Næss et al., "Reading Skills in Children with Down Syndrome: A Meta-Analytic Review," *RDD* 33, no. 2 (2012): 737–47; Gary E. Martin et al., "Language Characteristics of Individuals with Down Syndrome," *Topics in Language Disorders* 29, no. 2 (2009): 8–9; L. Verucci, D. Menghini, and S. Vicari, "Reading Skills and Phonological Awareness Acquisition in Down Syndrome," *JIDR* 50, no. 7 (2006): 477–91; Donna Boudreau, "Literacy Skills in Children and Adolescents with Down Syndrome," *Reading and Writing* 15, no. 5 (2002): 497–525; Elizabeth Kay-Raining Bird, Patricia L. Cleave, and Lyndsey McConnell, "Reading and Phonological Awareness in Children with Down Syndrome: A Longitudinal Study," *AJSLP* 9, no. 4 (2000): 319–30.

[46] In a field where terms are often used in various ways, an extra effort is made to clarify the meanings of these terms to "provide the clearest information possible" and to allow for replicability of the research. McCardle and Hoff, "An Agenda for Research," 160. See also Rebecca Ward, "Profiling the Language Abilities of Welsh-English Bilingual Children with Down Syndrome" (PhD diss., Bangor University, 2020), 21.

everyday functioning and affects the development and maintaining of relationships.[47]

Bilingual. Generally speaking, a bilingual person is one who can "produce, comprehend, read or write more than one language."[48] In the context of the research referenced in this study, unless otherwise specified, a *bilingual person* is one who is regularly exposed to two or more languages and generally uses those languages in their daily life.[49] This distinguishes them from those *second language learners* such as *foreign language learners* who are learning a language in a context in which that language is not needed or used in daily life.[50]

Comprehensible input. Any language which a learner hears or sees (in spoken, written, or signed form), which is understandable to the learner.[51]

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[47] American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders: DSM-5*, 5th ed. (Arlington, VA: American Psychiatric Association, 2013), 50–53. Though literature cited here may refer to various diagnoses such as Asperger's disorder, high-functioning autism, infantile autism, or pervasive developmental disorder not otherwise specified, the terms "autism" or "ASD" will generally be used, as an ASD diagnosis now encompasses these disorders, in accordance with the latest edition of the *Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Association, *Diagnostic and Statistical Manual*, 53.

[48] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 49.

[49] François Grosjean, "A Psycholinguistic Approach to Code-Switching: The Recognition of Guest Words by Bilinguals," in *One Speaker, Two Languages: Cross-Disciplinary Perspectives on Code-Switching*, ed. Lesley Milroy and Pieter Muysken (Cambridge: Cambridge University Press, 1995), 259; Rebecca Ward adheres to this same understanding of *bilingual* in her research on bilingualism in preschoolers with Down Syndrome. Ward, "Profiling the Language Abilities," 20.

[50] It is important to note that bilingualism exists on a continuum, and it may be said that as soon as an individual begins acquiring an L2, they are on the continuum of bilingualism. Richard Diebold refers to this as "incipient bilingualism." A. Richard Deibold, "Incipient Bilingualism," *Language* 37, no. 1 (1961): 99. For further detail on the concept of bilingualism as a continuum, see William F. Mackey, "The Description of Bilingualism," in *The Bilingualism Reader*, ed. Li Wei (London: Routledge, 2000), 26–27. Blake Turnbull argues that FL learners should be considered emergent bilinguals. He thus defines an emergent bilingual as "any person who is actively in the process of acquiring knowledge of a second language and developing bilingual languaging skills for use in a given situation relevant to their individual needs to learn the TL." Blake Turnbull, "Reframing Foreign Language Learning as Bilingual Education: Epistemological Changes towards the Emergent Bilingual," *International Journal of Bilingual Education and Bilingualism* (September 2016): 3.

[51] Bill VanPatten, Megan Smith, and Alessandro G. Benati, *Key Questions in Second Language Acquisition: An Introduction* (Cambridge: Cambridge University Press, 2019), 45, 197; Richards

Developmental Language Disorder. An impairment of language ability which does not affect or necessitate the presence of impairment of hearing, nonverbal intelligence, neurological function and other domains of health or physical features such as oral motor structure and function which may affect the ability to speak properly.[52] DLD is "severe enough to interfere with daily life, (has) a poor prognosis and (is) not associated with a clear biomedical aetiology."[53] In this study the term may be used synonymously with Specific Language Impairment (SLI).[54]

Down syndrome. A syndrome caused by additional chromosome 21 (in whole

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and Schmidt, *Longman Dictionary of Language Teaching*, 108. The term comprehensible input was popularized by Stephen Krashen, beginning with his seminal work *Principles and Practice in Second Language Acquisition*, though many other scholars recognized the concept before him. See Stephen Krashen, "Who Invented Comprehensible Input?," *International Journal of Language Teaching* 12, no. 2 (2017): 32–33. Krashen now refers to the necessity of comprehensible input for language acquisition as the Comprehension Hypothesis but originally referred to it as the Input Hypothesis. Stephen Krashen, "The Comprehension Hypothesis Extended," in *Input Matters in SLA*, ed. Thorsten Piske and Martha Young-Scholten, Second Language Acquisition (Bristol, UK: Multilingual Matters, 2009), 81; Stephen D. Krashen, *Principles and Practice in Second Language Acquisition*, internet ed., Stephen Krashen, 2009, 20–30. *Principles and Practice in Second Language Acquisition* was originally published in 1982.

[52] Laurence B. Leonard, "Specific Language Impairment across Languages," *Child Development Perspectives* 8, no. 1 (March 2014): 1; Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with DD," 2; Zoutenbier and Zwitserlood, "Exploring the Relationship," 1.

[53] Dorothy V. M. Bishop et al., "Phase 2 of CATALISE: A Multinational and Multidisciplinary Delphi Consensus Study of Problems with Language Development: Terminology," *Journal of Child Psychology and Psychiatry* 58, no. 10 (2017): 1078. The phrase "poor prognosis" means that the problems are "long-standing and unresponsive to general educational practices." Karla K. McGregor et al., "Developmental Language Disorder: Applications for Advocacy, Research, and Clinical Service," *Perspectives of the ASHA Special Interest Groups* 5, no. 1 (2020): 39.

[54] Developmental Language Disorder is now the accepted terminology. Bishop et al., "Phase 2 of CATALISE," 1068–80. However, due to the prevalence of Specific Language Impairment in the precedent literature, it may be necessary at times to use the terminology of SLI. For an in-depth analysis of the discussion which led to the change in terminology, see Dorothy V. M. Bishop, "Why Is It So Hard to Reach Agreement on Terminology? The Case of Developmental Language Disorder (DLD)," *IJLCD* 52, no. 6 (2017): 671–80. Using the current definition of DLD, children with Down syndrome would not be diagnosed as having a DLD, but rather a "language disorder associated with Down syndrome," since the cause of language problems in DS "is likely different from the cause of DLD." McGregor et al., "Developmental Language Disorder," 39. SLI differs from DLD in that "the term DLD can apply to the language problems of individuals who have co-occurring conditions that impair cognitive, sensorimotor, or behavioral functioning but whose causal relation to language disorder is unknown." McGregor et al., "Developmental Language Disorder," 39. However, the term DLD does not necessitate the presence of a co-occurring condition.

or in part) which can take one of three forms: (1) Trisomy 21—an extra whole chromosome 21 is present in every cell of the body. Trisomy 21 is the most common form of Down syndrome, present in 95 percent of all cases of DS; (2) Translocation—an extra part of chromosome 21 is present and attaches itself to another chromosome; (3) Mosaicism—an extra whole chromosome 21 is present in some cells of the body. Mosaicism is the least common form of DS, making up only 1 percent of individuals with DS.[55] DS is associated with various health challenges, cognitive delays, and language impairments, some of which will be discussed in chapter 2.

Dual diagnosis. In the context of this study the use of the term *dual diagnosis* refers to an individual with DS that also has a diagnosis of autism spectrum disorder. This may also be referred to as a comorbid diagnosis.[56]

Inclusion/inclusive classroom. In the context of the foreign language classroom, *inclusion* entails presuming the competence of each student to acquire the language. The presence and participation of each student is valued, and the class is designed so that every child can participate in and benefit from classroom activities and experience reciprocal social relationships.[57]

Input. Any language which a learner hears or sees (in spoken, written, or signed form), especially in a communicative context in which the learner is actively seeking to understand the message (as opposed to for the purpose of explicit

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[55] Mark Selikowitz, *Down Syndrome: The Facts*, 3rd ed. (Oxford: Oxford University Press, 2008), 36–42.

[56] See, for example, Alexandria Cook, Emily D. Quinn, and Charity Rowland, “Exploring Expressive Communication Skills in a Cross-Sectional Sample of Individuals with a Dual Diagnosis of Autism Spectrum Disorder and Down Syndrome,” *American Journal on Intellectual and Developmental Disabilities* 126, no. 2 (2021): 97–113.

[57] TASH, “Inclusive Education,” accessed January 26, 2021, https://tash.org/advocacy-issues/inclusive-education/; Committee on the Rights of Persons with Disabilities, “General Comment No. 4 on Article 24: Right to Inclusive Education” (adopted at the Convention on the Rights of Persons with Disabilities, 2016), Article 11.

instruction).[58]

Integration/Integrated classroom. In an *integrated* foreign language classroom, students with disabilities are present in the classroom with their peers. They are not segregated from their peers by being sent to another place or denied the opportunity to attend the foreign language class. Mere integration, however, does not guarantee that students are truly a part of the classroom and learning. Effective integration results in *inclusion*.[59]

Foreign language. Any language that is neither the native language of an individual nor the language widely spoken in the society in which that individual lives. In the context of this study, a *foreign language* is one which is not the native language of the country in which an individual resides, nor is it the language of instruction in the school.[60] Additionally, the term *foreign language* is used to distinguish foreign language learning to that of *second language learning* by those who are learning as a second language the dominant language of the society in which they live.[61] Finally, the context of

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[58] VanPatten, Smith, and Benati, *Key Questions in Second Language Acquisition*, 44–45; Richards and Schmidt, *Longman Dictionary of Language Teaching*, 286.

[59] Committee on the Rights of Persons with Disabilities, "General Comment No. 4," Article 11.

[60] Richards and Schmidt, *Longman Dictionary of Language Teaching*, 224; Annette M. B. de Groot and Janet G. van Hell, "Learning Foreign Language Vocabulary," in Kroll and de Groot, *Handbook of Bilingualism: Psycholinguistic Approaches*, 25n1.

[61] It should be noted that for native speakers of a language who live where said language is not the dominate language of society, the language is not foreign. Often times, those languages which are called foreign coexist alongside the dominant language, albeit in minority. Ryuko Kubota and Theresa Austin, "Critical Approaches to World Language Education in the United States: An Introduction," *Critical Inquiry in Language Studies* 4, no. 2–3 (2007): 74. Though for this reason I would prefer to use the term *world language* or *modern language*, for the sake of clarity and consistency with past and current research, I will employ the term *foreign language*. I should note that though my approach to the term *foreign language* is somewhat critical, this study is not founded upon a critical approach to research on second language acquisition or language teaching. For further discussion on a critical approach to SLA research and language education, see Kubora and Austin, "Critical Approaches to World Language Education," 74–78. For further discussion on the problematic use of the word foreign in second language education, see Diane Larsen-Freeman and Donald Freeman, "Language Moves: The Place of 'Foreign' Languages in Classroom Teaching and Learning," *Review of Research in Education* 32, no. 1 (2008): 147.

the foreign language classroom differs from that of immersion or dual language programs due to the limited contact hours with the second language typical in the foreign language classroom, and that in immersion or dual language programs the second language is the language of instruction for at least part of the school day.[62]

Language acquisition. Refers to the subconscious process of the language entering the mind/brain which occurs as a result of receiving comprehensible input in the language. During language acquisition, learners do not consciously focus on the rules of grammar and sounds of the language, but rather on communication – understanding or expressing a message. As opposed to language learning, there is "no conscious awareness of the formal properties of language involved" in the process of *language acquisition*.[63]

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[62] An additional caveat which may distinguish the foreign language classroom context from that of an immersion or dual language program is that for some students, the second language being learned is not a foreign language but rather the dominant language of the community where they live. For example, for a native Spanish speaker in the United States enrolled in an English-Spanish dual language program, their second language (English) is the dominant language. Conversely, for a native English speaker in a Spanish immersion program their second language (Spanish) is not the majority language and therefore may be considered a foreign language. See Fred Genesee and Kathryn Lindholm-Leary, "Two Case Studies of Content-Based Language Education," *Journal of Immersion and Content-Based language Education* 1, no. 1 (2013): 3–33, and Helena Curtain, Richard Donato, and Victoria Gilbert, "Elementary School Foreign Language Programs in the United States," in *Foreign Language Education in America: Perspectives from K–12, University, Government, and International Learning*, ed. Steven Berbeco (London: Palgrave Macmillan, 2016), 21, for further description of foreign/second language immersion and dual language education. However, the immersion and dual language learning contexts differs vastly from the typical foreign language classroom due to the hours and frequency of exposure, and that the second language is also a language of instruction. For example, "in French immersion (IMM) programs in Canada, at least 50% of academic instruction is delivered through French during one or more grades in elementary and/or secondary school for majority language English-speaking students." Genesee and Lindholm-Leary, "Two Case Studies," 7. This may be contrasted with a typical FL classroom setting in which students only spend on average between two to three hours a week in the FL classroom. Laura Collins and Carmen Muñoz, "The Foreign Language Classroom: Current Perspectives and Future Considerations," *The Modern Language Journal* 100, no. S1 (2016): 138.

[63] VanPatten, Smith, and Benati, *Key Questions in Second Language Acquisition*, 150. See also Stephen Krashen, *Second Language Acquisition and Second Language Learning*, internet ed., Stephen Krashen, 2002, http://www.sdkrashen.com/content/books/sl_acquisition_and_learning.pdf, 1–2; Krashen, *Principles and Practice*, 10–11. I acknowledge that some may use language *acquisition* and language *learning* synonymously to simply refer to "the learning and development of a person's language." Richards and Schmidt, *Longman Dictionary*, 312. However, I find it helpful to distinguish between the two as the distinction holds pedagogical implications. Generally speaking, language *acquisition* is facilitated by implicit teaching methods, while language *learning* is facilitated by explicit methods of teaching. See Bill

Language learning. Refers to the explicit, conscious process of learning a language. Learners are focused on the rules of grammar, memorization of vocabulary, and sounds of the language. *Language learning r*esults in explicit knowledge which cannot be transformed into implicit knowledge and only serves a limited purpose for use in real-time communication.[64]

Productive lexical ability. Generally, *productive lexical ability* refers to the ability of an individual to actively produce vocabulary in spoken, written, or signed form.[65] This study will only assess vocabulary produced in spoken form. It may also be referred to as *expressive lexical ability*.[66] Lexical/lexicon and vocabulary will be used interchangeably throughout this study.[67]

Receptive lexical ability. For the purposes of this research, *receptive lexical ability* refers to the ability of an individual to understand spoken or signed vocabulary.[68]

VanPatten, "Why Explicit Knowledge Cannot become Implicit Knowledge," *Foreign Language Annals* 49, no. 4 (2016): 650–57, regarding the distinction between the roles of implicit and explicit teaching. I also understand that the distinction between learning and acquisition and the roles implicit and explicit instruction play in second language acquisition/learning are not clear cut and are still up for debate. For a helpful summary of this issue, see Nick C. Ellis, "Implicit and Explicit SLA and Their Interface," in *Implicit and Explicit Language Learning: Conditions, Processes, and Knowledge in SLA and Bilingualism*, ed. Cristina Sanz and Ronald P. Leow, Georgetown University Round Table on Languages and Linguistics Series (Washington, DC: Georgetown University Press, 2010), 35–47.

[64] VanPatten, Smith, and Benati, *Key Questions in Second Language Acquisition*, 150; Krashen, *Second Language Acquisition and Learning*, 1–2; Krashen, *Principles and Practice*, 10–11.

[65] Richards and Schmidt, *Longman Dictionary*, 462; González-Fernández and Schmitt, "Vocabulary Acquisition," 284.

[66] For example, see Todd A. Gibson et al., "The Receptive-Expressive Gap in the Vocabulary of Young Second-Language Learners: Robustness and Possible Mechanisms," *Bilingualism (Cambridge, England)* 15, no. 1 (2012): 102–16.

[67] Andreas Rohde, "Receptive L2 Lexical Knowledge in Bilingual Preschool Children," in *Bilingual Preschools*, vol. 1, *Learning and Development*, ed. Kristin Kersten et al. (Trier, Germany: Wissenschaftlicher Verlag Trier, 2010), 45n2. See also David Singleton, *Exploring the Second Language Mental Lexicon* (Cambridge: Cambridge University Press, 1999), 162.

[68] Richards and Schmidt, *Longman Dictionary*, 462; González-Fernández and Schmitt, "Vocabulary Acquisition," 284. The ability to understand the written word is also a part of lexical receptivity but was not measured in this study.

Second language. Any language that one is learning (or acquiring) after having acquired a native language.[69]

Second language learner. A person who is learning (or acquiring) a language which is not their native language. This language could be the dominant language of the society in which the individual lives, or a language which may be considered a foreign language.[70] The participants in the study are *second language learners* but not *bilingual* since they are not regularly exposed to their second language, nor do they use their second language in their daily life.

Methodology

An exploratory mixed methods multiple case study design was used. A mixed methods multiple case study design was employed to develop an enhanced understanding of initial second language acquisition in children with DS with and without a comorbid diagnosis of ASD through the collection of both quantitative and qualitative data and the analysis of multiple cases.[71] The first phase consisted of two primary components:

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[69] Richards and Schmidt, *Longman Dictionary*, 514. However, in the case of young children, the first language may still be in development when the second language is introduced. Such children may be referred to as simultaneous or sequential bilinguals, depending upon when the second language is introduced. Though there is not a precise consensus, introduction of the second language at three-years old often serves as the distinguishing factor between simultaneous and sequential bilingualism. Smolander et al., "L2 Vocabulary Acquisition," 74; Anne Dorothee Roesch and Vasiliki Chondrogianni, "'Which Mouse Kissed the Frog?' Effects of Age of Onset, Length of Exposure, and Knowledge of Case Marking on the Comprehension of Wh-Questions in German-Speaking Simultaneous and Early Sequential Bilingual Children," *Journal of Child Language* 43, no. 3 (2016): 636; Roxanna Ruiz-Felter et al., "Influence of Current Input–Output and Age of First Exposure on Phonological Acquisition in Early Bilingual Spanish–English-Speaking Kindergarteners," *IJLCD* 51, no. 4 (2016): 373. However, this is different than when the child is introduced from two languages at birth, in which case both languages would be considered a first language. This is referred to as bilingual first language acquisition, though these children may also be referred to as simultaneous bilinguals. Fred Genesse, "Bilingual First Language Acquisition in Perspective," in McCardle and Hoff, *Childhood Bilingualism*, 46; Roesch and Chondrogianni, "'Which Mouse Kissed the Frog?,'" 636.

[70] Richards and Schmidt, *Longman Dictionary*, 514; de Groot and van Hell, "Learning Foreign Language Vocabulary," 25n1.

[71] John W. Creswell and Vicki L. Plano Clark, *Designing and Conducting Mixed Methods Research*, 3rd ed. (Los Angeles: SAGE, 2018), 116.

implementation of the experiment, that is, teaching Spanish to children with DS, and multiple case studies of children with DS who are participating in the Spanish FL classroom. The method of case studies is applicable, since there is very little research conducted on the nature of second language acquisition in individuals with DS.[72] The study began with three categories of assessments of the research sample: an assessment of nonverbal intelligence, an assessment of verbal short-term memory (VSTM), and English vocabulary assessments.[73] These assessments served to develop a profile for each participant and as predictor measures for how participants may differ in their acquisition of Spanish.[74]

The qualitative portion of the study lasted for six weeks, during which time all participants attended Spanish class every day, Monday through Friday, for forty-five minutes.[75] The classes took place at Down Syndrome of Louisville in conjunction with an academic enrichment summer camp for children with DS, and I taught the classes. Of those children that participated in the study only one or two per class were part of the multiple case study, for a total of five case studies.[76] For the students who participated in

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[72] Paul D. Leedy and Jean Ellis Ormrod, *Practical Research: Planning and Design*, 11th ed. (New York: Pearson, 2016), 254; Sue Buckley recommends case studies as a starting point for researching L2 acquisition in children with DS. Sue Buckley, "Can Children with Down Syndrome Learn More Than One Language?," *Down Syndrome News and Update* 2, no. 3 (2002): 100.

[73] No Spanish pre-tests were administered.

[74] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 10.

[75] The six weeks was divided into two three-week sessions, with a week without classes in-between.

[76] The number of participants with DS in the study far exceed the recommended number of participants for a multiple case study, and thus I could only choose one or two from each class. While everyone's data was included in the quantitative assessment of language acquisition, it was not feasible to conduct an in-depth case study of every participant in the study. The maximum number of case studies that I would accept was five, due to the feasibility of collecting and synthesizing data. An initial invitation to participate in a case study was extended to every participant. Only a couple of parents responded to the initial invitation. Follow up invitations were extended to children who I felt represented a variety of cognitive and linguistic abilities and were participating in various classes. John Creswell and Cheryl Poth

the case studies, I observed the students' participation in the Spanish classroom. Classes were video recorded so that I could accurately record their habits of participation and evidence of acquisition of the Spanish language as demonstrated in the classroom.

Upon completion of the Spanish intervention, the quantitative portion of the study assessed the receptive and expressive lexical development in Spanish of the intervention participants. I developed my own instrumentation based on instrumentation used in other studies to assess lexical acquisition of Spanish in order to tailor the questions to the input the students received in the class. I developed one instrument to assess receptive lexical acquisition, and one instrument to assess expressive lexical acquisition. The development of my own instrumentation is in line with a three-phase exploratory mixed methods design "in which the researcher first begins by exploring with qualitative data and analysis, then builds a feature to be tested . . . and tests this feature in a quantitative third phase."[77] In the third phase I assessed the receptive and expressive lexical Spanish acquisition of the intervention participants. For each domain (receptive and expressive Spanish vocabulary) I administered a standardized test and my own instrumentation which I developed in the second stage. Since the development of my own instrumentation "(captured) the material that the children were directly exposed to" in class, it "may reveal better performance and give a wider range of performance" than

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offer four to five cases as the norm for multiple case studies. John W. Creswell and Cheryl N. Poth, *Qualitative Inquiry and Research Design: Choosing among Five Approaches* (Los Angeles: SAGE, 2016), 161.

[77] John W. Creswell and J. David Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. (Los Angeles: SAGE, 2017), 224. Unlike the traditional three-phase exploratory mixed methods design, in which separate research participants are used in phase 1 than in phase 3, the same subjects were used for the quantitative phase of the study as for the qualitative phase of the study. This is due to the nature of the research. Those students who participated in the class, based off of which the instrumentation was formed, must be the same ones who receive the assessment. Thus, the reasons for using different populations in the quantitative and qualitative phases of the study offered in the literature are not applicable in this study. See Creswell and Creswell, *Research Design*, 225; Creswell and Plano Clark, *Designing and Conducting Mixed Methods,* 192–93.

what could be captured through the standardized assessments.[78] Results from these assessments were analyzed to compare the receptive and expressive lexical development in Spanish of the children with DS, compare the Spanish acquisition of the participants with a dual diagnosis to those with DS only, and to determine which variables correlated with L2 acquisition in children with DS. Additionally, participants were administered English receptive and expressive vocabulary assessments post-intervention. The English vocabulary pre- and post-test scores of the intervention participants were compared to determine the impact of participation in a six-week FL classroom on L1 development. The qualitative and quantitative data was then combined to provide an overall language acquisition profile of each child who participated in the multiple case study.

Limits of Generalization

Several limits exist to the generalization of the findings in this study. First, those participants with DS in this study may not be fully representative of all individuals with DS. The cognitive and language abilities of individuals with DS vary greatly, and it is possible that the lowest or highest scale of language and cognitive abilities present in some individuals with DS was not fairly represented in the study. Secondly, the context of the class in which the students learned Spanish was not the school setting. Elementary FL programs vary vastly in the amount and frequency of exposure to the second language, as well as curriculum content and methodology.[79] Variance in any one of these factors will inevitably result in varying second language acquisition outcomes. While the frequency of exposure for this class was higher than what is typical for an elementary FL class, the

[78] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14.

[79] Curtain, Donato, and Gilbert, "Elementary School Foreign Language Programs," 19–20, 25–31.

duration of exposure was much less.[80] Additionally, unlike a typical school setting, many participants with DS in the study did not know each other apart from their participation in the summer camp in which the classes took place. This may have raised their affective filter and lowered their receptibility to acquisition.[81] Therefore, the acquisition achieved by the students in the study may not be equal to what they might attain were the class in their own school with their classmates.

Finally, this study assessed the acquisition of Spanish vocabulary by native English speakers, and it should not be presumed that the same results would be obtained given different languages.[82] Spanish and English share the same alphabet and many cognates, and the similarities may benefit acquisition.[83] As cognates may facilitate vocabulary learning, the same level of acquisition may not be achieved, given the same amount of input, when acquiring a language with fewer cognates.[84]

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[80] These factors and their possible effect on acquisition will be discussed in further detail in chapters 2 and 5.

[81] Krashen's Affective Filter hypothesis posits that when the affective filter is high, language acquisition decreases. See Krashen, *Principles and Practice*, 30–33.

[82] Smolander and colleagues recognize that results of vocabulary acquisition may vary depending on the similarity and differences of the L1 and L2. Smolander et al., "L2 Vocabulary Acquisition," 76.

[83] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 55.

[84] Martin Willis and Yoshie Ohashi, "A Model of L2 Vocabulary Learning and Retention," *The Language Learning Journal* 40, no. 1 (2012): 127, 131, 133. Eva Lindgren and Carmen Muñoz found that cognate linguistic difference is a key predictor of receptive language acquisition. Eva Lindgren and Carmen Muñoz, "The Influence of Exposure, Parents, and Linguistic Distance on Young European Learners' Foreign Language Comprehension," *International Journal of Multilingualism* 10, no. 1 (2013): 105–29. However, Smolander and colleagues argue that the usefulness of cognates in acquiring vocabulary is limited. Smolander et al., "L2 Vocabulary Acquisition," 74. Caroline Floccia et al. found that phonological similarity is helpful for vocabulary production, while typological and morphological closeness contribute to vocabulary comprehension. Caroline Floccia et al., "Vocabulary of 2-Year-Olds Learning English and an Additional Language: Norms and Effects of Linguistic Distance: III: Analyses and Results for Study 1: Estimating the Effect of Linguistic Distance on Vocabulary Development," *Monographs of the Society for Research in Child Development* 83, no. 1 (2018): 60.

Research Assumptions

1. The medical diagnoses of Down syndrome and ASD provided by the families of the participants are accurate and reliable.

2. The assessment used to measure nonverbal intelligence (KBIT-2) is a valid measure of nonverbal intelligence.

3. The assessment used to measure English receptive vocabulary (PPVT-4) is a valid instrument and an accurate measurement of receptive vocabulary in English.

4. The assessment used to measure expressive vocabulary in English (EVT-2) is a valid instrument and measurement of expressive vocabulary.

5. The assessment used to assess Spanish receptive vocabulary (ROWPVT-B) is a valid instrument and an accurate measurement of receptive vocabulary in Spanish.

6. The assessment that used to assess expressive vocabulary in Spanish (EOWPVT-B) is a valid instrument and measurement of expressive vocabulary.

7. The nonword repetition task used is a valid instrument and accurate measurement of verbal short-term memory.

Conclusion

This study addresses a significant gap in the literature. Virtually no research to date has addressed the topic of second language acquisition by children with DS in the FL context nor their participation in the FL classroom. Utilizing an exploratory mixed methods multiple case study design, this study sought to describe the beginning stages of second language acquisition in children with DS with and without a dual diagnosis of ASD, and provide for FL teachers an example of inclusion and pedagogy for students with DS in the FL classroom.[85] A deeper understanding of the physical, cognitive, behavioral, and language development of individuals with DS with and without a dual diagnosis of ASD, as well as the current research on bilingualism and FL learning in individuals with DS and similar populations, and general factors of second language

[85] Though no TD students participated in the intervention, and thus it cannot be claimed that this study is an example of inclusion in the fullest sense, it does set a precedent for how children with DS of varying cognitive and linguistic capabilities can effectively be included and participate in the FL classroom.

acquisition will help set the stage for this study. These fundamental topics are the focus of chapter 2.

CHAPTER 2

PRECEDENT LITERATURE

The purpose of this study is to examine the beginning stages of second language acquisition of children with Down syndrome in the foreign language classroom. Additionally, this study seeks to describe the participation of children with DS in the FL classroom and thus provide FL teachers an example of inclusion for students with DS in the FL classroom. To do so necessitates not only an understanding of the language abilities of children with DS, but their physical, cognitive, and behavioral development as well. After reviewing these aspects of development in individuals with DS, this review will explore the research on bilingualism in children with DS. Furthermore, it will explore FL learning in populations similar to that of the DS population and factors of second language (L2) acquisition. Finally, this review will describe L1 development in children with ASD, development in children with a dual diagnosis of DS and ASD, and bilingualism in these two populations.

Down Syndrome

DS is the most prevalent cognitive and chromosomal disorder, accounting for approximately 15 out of 10,000 live births in the United States.[1] As a congenital syndrome, DS is present from birth and characterized by "a cluster of features which occur together."[2] This cluster of features, while commonly referring to physical features,

[1] Cara T. Mai et al., "National Population-Based Estimates for Major Birth Defects, 2010–2014," *Birth Defects Research* 111, no. 18 (2019): 6.

[2] Mark Selikowitz, *Down Syndrome: The Facts*, 3rd ed. (Oxford: Oxford University Press, 2008), 26; L. Devlin and P. J. Morrison, "Accuracy of the Clinical Diagnosis of Down Syndrome," *The Ulster Medical Journal* 73, no. 1 (2004): 10.

also includes clinical, cellular, and physiological components, medically referred to as a "phenotype."[3] As many as 120 different features have been associated with DS, yet only a handful may be present in any one child.[4] Though the syndrome is present from birth, it is not always diagnosed immediately after birth, due in part to the variance of manifestation of the phenotypic features typically associated with DS.[5]

DS is caused by an abnormality in the twenty-first chromosome, manifested in three different ways: trisomy 21, translocation, and mosaicism. Trisomy 21 is characterized by an extra whole chromosome 21 in every cell of the body, and is the most common form of DS, accounting for approximately 90 to 95 percent of all cases.[6] Translocation occurs in approximately 2 to 4 percent of DS cases and is a result of an

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[3] Julie R. Korenberg et al., "Down Syndrome Phenotypes: The Consequences of Chromosomal Imbalance," *Proceedings of the National Academy of Sciences* 91, no. 11 (1994): 4997.

[4] Selikowitz, *Down Syndrome*, 28; Korenberg et al., "Down Syndrome Phenotypes," 4998; Stylianos E. Antonarakis and Charles J. Epstein, "The Challenge of Down Syndrome," *Trends in Molecular Medicine* 12, no. 10 (2006): 475; Kenneth Lyons Jones, Marilyn Crandall Jones, and Miguel del Campo Casanelles, *Smith's Recognizable Patterns of Human Malformation*, 7th ed. (Philadelphia: Elsevier Saunders, 2013), 3.

[5] Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 5–11; Selikowitz, *Down Syndrome*, 28; Mikyong Shin, Csaba Siffel, and Adolfo Correa, "Survival of Children with Mosaic Down Syndrome," *American Journal of Medical Genetics Part A* 152A (2010): 800; Paulie Papavassiliou et al., "Mosaicism for Trisomy 21: A Review," *American Journal of Medical Genetics Part A* 167, no. 1 (2015): 27. Some of the most common and identifiable physical features of DS include (1) simian (a singular transverse crease in the palm of the hand, as opposed to the usual two), (2) sandal gap (a wider than usual gap between the first and second toe), (3) epicanthic folds (a skin fold of the upper eyelid which covers the inner corner of the eye), (4) hypotonia (weak muscle tone), (5) upslanting palpebral features (eyes that appear to slant upward), (6) protruding tongue, (7) low set or small ears, (8) short neck, loose neck skin, or increased neck skin thickness, (9) a flat facial profile, and (10) mouth corners turned downward. Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 7, 10–11; K. Fried, "A Score Based on Eight Signs in the Diagnosis of Down Syndrome in the Newborn," *Journal of Mental Deficiency Research* 24, no. 3 (1980): 181–85; Bruce R. Korf, David L. Rimoin, and Reed E. Pyeritz, "Nature and Frequency of Genetic Disease," in *Emery and Rimoin's Essential Medical Genetics*, ed. David L. Rimoin, Reed E. Pyeritz, and Bruce R. Korf (Oxford: Academic Press, 2013), 3, 8; Jones, Jones, and del Campo Casanelles, *Smith's Recognizable Patterns*, 7–8; Selikowitz, *Down Syndrome*, 28–31.

[6] Selikowitz, *Down Syndrome*, 37; Papavassiliou et al., "Mosaicism for Trisomy 21," 26; Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 10; Shin, Siffel, and Correa, "Survival of Children," 800.

extra portion of chromosome 21, as opposed to a whole chromosome.[7] Individuals with translocation do not differ in the degree of severity of intellectual impairment nor the manifestation of clinical features as compared to individuals with trisomy 21.[8] Mosaicism, characterized by an extra whole chromosome 21 in multiple cells of the body, occurs in approximately 2 to 4 percent of DS cases.[9] In general, individuals with mosaic DS do not present as many clinical features of DS as do those with trisomy 21 or translocation, resulting in a lower detection rate.[10] Additionally, it seems that individuals with mosaic DS may have higher cognitive abilities and better social conditions than those individuals with trisomy 21, though still lagging behind TD peers.[11]

Physical Development

The physical development of individuals with DS is characterized by marked individual differences, and diverges from that of the general population in various ways.[12] In addition to the phenotypic physical features which outwardly distinguish individuals

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[7] Selikowitz, *Down Syndrome*, 39; Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 10; Papavassiliou et al., "Mosaicism for Trisomy 21," 26; Shin, Siffel, and Correa, "Survival of Children," 800.

[8] Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 5; Eran Bornstein et al., "Complete Trisomy 21 vs Translocation Down Syndrome: A Comparison of Modes of Ascertainment," *American Journal of Obstetrics and Gynecology* 203, no. 4 (2010): 391.e1–e5; Selikowitz, *Down Syndrome*, 40.

[9] Selikowitz, *Down Syndrome*, 42; Shin, Siffel, and Correa, "Survival of Children," 800; Papavassiliou et al., "Mosaicism for Trisomy 21," 26–28; Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 10.

[10] Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 10; Shin, Siffel, and Correa, "Survival of Children," 800; Papavassiliou et al., "Mosaicism for Trisomy 21," 27.

[11] Papavassiliou et al., "Mosaicism for Trisomy 21," 32; Jin Liang Zhu and colleagues found that adults with mosaic DS in Denmark had higher levels of education and higher rates of employment, income, marital status, and birth than those with other types of DS. Jin Liang Zhu et al., "Social Conditions for People with Down Syndrome: A Register-Based Cohort Study in Denmark," *American Journal of Medical Genetics Part A* 164, no. 1 (2014): 1–13.

[12] Annette Karmiloff-Smith et al., "The Importance of Understanding Individual Differences in Down Syndrome [version 1; referees: 2 approved]," *F1000Research* 5 (2016): 1–10.

with DS from the TD population, the skeletal and muscular systems differ from those of the TD population.[13] Individuals with DS face a variety of impairments in their physical development and health which may affect their cognitive and/or language development. Some of the most common physical impairments in the DS population include delayed motor development, hearing loss, heart defects, vision impairment, weak muscle tone, oral-motor structure and function, and sleep disturbances**.**

Motor development. Individuals with DS lag behind their peers in motor development, and the variability of motor development within the DS population is much wider than that of the TD population.[14] While children with DS generally follow the same sequence of motor development milestones, reaching those milestones may take twice as long for children with DS than their TD peers.[15] Additionally, delays in motor development can be exacerbated by surgery for medical conditions, common among children with DS.[16] The rate of motor development slows as the complexity of skills increases, declining noticeably by three years of age, so that by the time children with DS are school-aged, some may not have fully reached all motor development milestones needed for functional skills and typical interaction and participation in school.[17] In

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[13] Carol Stoel-Gammon, "Down Syndrome Phonology: Developmental Patterns and Intervention Strategies," *DSRP* 7, no. 3 (2001): 94.

[14] P. Winders, K. Wolter-Warmerdam, and F. Hickey, "A Schedule of Gross Motor Development for Children with Down Syndrome," *JIDR* 63, no. 4 (2019): 351.

[15] Hyo In Kim et al., "Motor and Cognitive Developmental Profiles in Children with Down Syndrome," *Annals of Rehabilitation Medicine* 41, no. 1 (2017): 99; Robert J. Palisano et al., "Gross Motor Function of Children with Down Syndrome: Creation of Motor Growth Curves," *Archives of Physical Medicine and Rehabilitation* 82, no. 4 (2001): 495.

[16] Kim et al., "Motor and Cognitive Developmental Profiles," 101.

[17] Palisano et al., "Gross Motor Function," 497–99; Roksana Malak et al., "Delays in Motor Development in Children with Down Syndrome," *Medical Science Monitor* 21 (2015): 1908; Michiel J. M. Volman et al., "Functional Status in 5 to 7-Year-Old Children with Down Syndrome in Relation to Motor Ability and Performance Mental Ability," *Disability and Rehabilitation* 29, no. 1 (2007): 29.

addition to negatively affecting functional skills, evidence seems to suggest that delayed motor acquisition has a negative effect on cognitive abilities. While one study found no significant correlation between reaching motor development milestones and cognitive function, a larger body of literature demonstrates a significant relationship between motor achievement and cognitive function, as well as language skills.[18]

Hearing loss. Individuals with DS are at increased risk of experiencing hearing loss throughout their life, whether transient or permanent.[19] As many as one-fourth of infants with DS may be born with congenital hearing loss, and as many as over two-thirds of children with DS experience some type of hearing loss.[20] While individuals

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[18] For no correlation see Kim et al., "Motor and Cognitive Developmental Profiles," 102. For evidence of a correlation between motor development and cognitive function, see Roksana Malak et al., "Motor Skills, Cognitive Development and Balance Functions of Children with Down Syndrome," *Annals of Agricultural and Environmental Medicine* 20, no. 4 (2013): 805; Yuko Yamauchi et al., "Motor and Cognitive Development of Children with Down Syndrome: The Effect of Acquisition of Walking Skills on their Cognitive and Language Abilities," *Brain and Development* 41, no. 4 (2019): 324; Jan Pieter Marchal et al., "Growing up with Down Syndrome: Development from 6 Months to 10.7 Years," *RDD* 59 (2016): 447. For evidence of correlation between motor development and language skills, see Yamauchi et al., "Motor and Cognitive Development," 324.

[19] Emily Nightengale et al., "Understanding Hearing and Hearing Loss in Children with Down Syndrome," *American Journal of Audiology* 26, no. 3 (2017): 301, 305–6. Not only are individuals with DS more likely to experience hearing loss than the general population but have higher rates of hearing loss when compared to other cognitively impaired populations as well. Michael M. Marcell et al., "Hearing Abilities of Down Syndrome and Other Mentally Handicapped Adolescents" (paper presented at the Annual Conference of the American Psychological Association, Boston, MA, August 1990), 7; Michael Marcell, "Relationships Between Hearing and Auditory Cognition in Down's Syndrome Youth," *Down Syndrome Research and Practice* 3 (1995): 75–91, accessed August 27, 2021, https://library.down-syndrome.org/en-gb/research-practice/03/3/relationships-hearing-auditory-cognition-down-syndrome-youth.

[20] Adrienne Tedeschi and colleagues found that 15 percent of infants were born with hearing loss, whereas Albert Park and colleagues found the percentage of infants who did not pass their newborn hearing screening to be as high as 26 percent. Adrienne S. Tedeschi et al., "The Prevalence of Congenital Hearing Loss in Neonates with Down Syndrome," *Journal of Pediatrics* 166, no. 1 (2015): 168–71; Albert H. Park et al., "Identification of Hearing Loss in Pediatric Patients with Down Syndrome," *Otolaryngology--Head and Neck Surgery* 146, no. 1 (2012): 136. For information on prevalence of hearing loss in childhood, see Nancy J. Roizen, "Down Syndrome (Trisomy 21)," in *Children with Disabilities*, 7th ed, ed. Mark L. Batshaw, Nancy J. Roizen, and Gaetano R. Lotrecchiano (Baltimore: Paul H. Brookes, 2013), 309. Two-thirds of the patients with DS tested by Balkany and colleagues were found to have significant hearing loss, and 66 percent of those tested by Roizen and colleagues. Thomas J. Balkany et al., "Hearing Loss in Down's Syndrome: A Treatable Handicap More

with DS can experience sensorineural hearing loss ("involving the cochlea or auditory nerve"), a more common cause for hearing loss in children with DS is conductive ("middle ear conduction of sound") hearing loss, especially as a result of otitis media.[21] Otitis media with effusion (OME; fluid in the middle ear), seems to peak in children with DS at age one, with a prevalence between at 67 to 93 percent, and again at age six with a 60 percent prevalence, declining after eight years of age, though such problems can persist into adulthood.[22]

In the general population, hearing loss is the most commonly reported symptom of OME, and such adverse impacts are greater in the DS population. Though such hearing loss generally resolves spontaneously within three to twelve months among TD children, acute otitis media can lead to permanent hearing loss.[23] Not all cases of

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Common Than Generally Recognized," *Clinical Pediatrics* 18, no. 2 (1979): 116–18; Nancy J. Roizen et al., "Hearing Loss in Children with Down Syndrome," *Journal of Pediatrics* 123, no. 1 (1993): S11. However, the prevalence is not always so high. Nightengale and colleagues found a prevalence of 36 percent, and De Schrijver, 47 percent. Nightengale et al., "Understanding Hearing," 304; L. De Schrijver et al., "Prevalence and Etiology of Sensorineural Hearing Loss in Children with Down Syndrome: A Cross-Sectional Study," *International Journal of Pediatric Otorhinolaryngology* 116 (2019): 168–72.

[21] Roizen, "Down Syndrome," 309. For the prevalence distribution of sensorineural hearing loss and conductive hearing loss as a result of otitis media in infants, see Park et al., "Identification of Hearing Loss," 138. For further evidence of sensorineural hearing loss, see De Schrijver et al., "Prevalence and Etiology," 168–72.

[22] M. Maris et al., "A Cross-Sectional Analysis of Otitis Media with Effusion in Children with Down Syndrome," *European Journal of Pediatrics* 173, no. 10 (2014): 1322–23; Though Emily Barr and colleagues found a strikingly high prevalence of otitis media with effusion among one-year old's, not all were symptomatic, and only a minority of the children diagnosed required intervention. Emily Barr et al., "The Prevalence of Ear, Nose and Throat Disorders in Preschool Children with Down's Syndrome in Glasgow," *Scottish Medical Journal* 56, no. 2 (2011): 101. However, Marit Erna Austeng and colleagues found that in eight year-old children with DS, otitis media was significantly associated with hearing loss. Marit Erna Austeng et al., "Otitis Media with Effusion in Children with Down Syndrome," *International Journal of Pediatric Otorhinolaryngology* 77, no. 8 (2013): 1330. For the definition of otitis media with effusion and other related terms, see Richard M. Rosenfeld et al., "Clinical Practice Guideline: Otitis Media with Effusion (Update)," *Otolaryngology–Head and Neck Surgery* 154, no. 1S (2016): S3. For evidence of persistence into adulthood, see Nightengale et al., "Understanding Hearing," 306.

[23] Ali Qureishi et al., "Update on Otitis Media–Prevention and Treatment," *Infection and Drug Resistance* 7 (2014): 16–17; Austeng et al., "Otitis Media with Effusion," 1329–32; Rosenfeld et al., "Clinical Practice Guideline," S5; Heather Fortnum et al., "Assessment of the Feasibility and Clinical Value of Further Research to Evaluate the Management Options for Children with Down Syndrome and

OME are symptomatic or cause hearing loss, yet the presence of OME during crucial formative years may have adverse effects on both cognitive and linguistic development, though the strength of such adverse effects is debatable.[24] Such adverse effects may be exacerbated in the DS population, for which cognitive and linguistic deficits are already characteristic.[25] The presence of OME in early childhood may negatively affect overall intellectual ability, school achievement, speech, and language.[26] More specifically, in TD infants, the presence of otitis media has been shown to negatively affect receptive and expressive language development, and infants with otitis media associated hearing loss have a ten times greater risk of developing a speech disorder than those without.[27] In the DS population, hearing loss has been found to contribute to decreased performance in auditory-cognitive tasks ("such as sentence imitation, language comprehension, backward masking of spoken words, word identification, auditory-verbal short-term memory,

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Otitis Media with Effusion: A Feasibility Study," *Health Technology Assessment* 18, no. 60 (2014): 1. Children with DS are also at an increased risk for acute otitis medias. Rosenfeld et al., "Clinical Practice Guideline," S15.

[24] Joanne Roberts et al., "Otitis Media, Hearing Loss, and Language Learning: Controversies and Current Research," *Journal of Developmental & Behavioral Pediatrics* 25, no. 2 (2004): 112–17.

[25] Fortnum et al., "Assessment of the Feasibility," 17; Robert J. Ruben, "Host Susceptibility to Sequelae," in *Evidence-Based Otitis Media*, 2nd ed., ed. Richard M. Rosenfeld and Charles D. Bluestone (Hamilton, Canada: BC Decker, 2003), 506; Joanne E. Roberts et al., "Meta-Analysis of Speech and Language Sequelae," in Rosenfeld and Bluestone, *Evidence-Based Otitis Media*, 395–97; Glynis Laws and Amanda Hall, "Early Hearing Loss and Language Abilities in Children with Down Syndrome," *International Journal of Language and Communication Disorders* 49, no. 3 (2014): 334, 339; Ben Sacks and Amanda Wood, "Hearing Disorders in Children with Down Syndrome," *Down Syndrome News and Update* 3, no. 2 (2003): 41; Lawrence D. Shriberg et al., "Otitis Media, Fluctuant Hearing Loss, and Speech-Language Outcomes: A Preliminary Structural Equation Model," *JSLHR* 43, no. 1 (2000): 106.

[26] Roberts et al., "Otitis Media, Hearing Loss, and Language Learning," 112–16; For example, Teele and colleagues found that time spent with OME in the first year of life was significantly inversely correlated with cognitive abilities at ages three and seven, with those children with the least amount of time spent with OME scoring higher than those with more time spent with OME. This general pattern held true for measurements of school achievement, speech, and language, though not all reached significance. David W. Teele et al., "Otitis Media in Infancy and Intellectual Ability, School Achievement, Speech, and Language at Age 7 Years," *Journal of Infectious Diseases* 162, no. 3 (1990): 68–90.

[27] Joanne E. Roberts et al., "Meta-analysis of Speech," 388, 397; Ina F. Wallace et al., "Otitis Media and Language Development at 1 Year of Age," *Journal of Speech and Hearing Disorders* 53, no. 3 (1988): 249; Shriberg et al., "Otitis Media," 112.

receptive vocabulary, and oral vocabulary"),[28] to negatively impact general language scores, speech accuracy and intelligibility, lexical development, word processing speed, and comprehension of syntax, grammatical morphemes, and vocabulary.[29]

Heart defects. Congenital heart disease (CHD) is one of the most common anomalies present in the DS population, with approximately 50 percent of infants suffering from congenital heart defects.[30] Though some research shows that CHD does

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[28] The auditory-cognitive tasks administered by Marcell were "language and memory tasks that required the initial processing of acoustic-verbal information, the forming of mental representations, and the performing of actions (e.g., speaking, pointing) based on the representations." Marcell, "Relationships Between Hearing." Marcell suggests that the lower performance by individuals with DS on such measurements when compared to CA-matched youth with other causes of intellectual impairment may be "due to an interaction of lower auditory acuity and slower processing speed."

[29] Laws and Hall, "Early Hearing Loss," 333–42; Giuliana Miolo, Robin S. Chapman, and Heidi A. Sindberg, "Sentence Comprehension in Adolescents with Down Syndrome and Typically Developing Children," *JSLHR* 48, no. 1 (2005): 172–88; Robin S. Chapman et al., "Predicting Language Production in Children and Adolescents with Down Syndrome: The Role of Comprehension," *JSLHR* 43, no. 2 (2000): 340–50; Robin S. Chapman, Scott E. Schwartz, and Elizabeth Kay-Raining Bird, "Language Skills of Children and Adolescents with Down Syndrome: I. Comprehension," *JSLHR* 34, no. 5 (1991): 1106–20; Marcell et al., "Hearing Abilities of Down Syndrome," 8. In some studies, the hearing loss accounted for anywhere between 4 to 8 percent variability. However, those studies also excluded individuals with DS with moderate to severe hearing loss. See Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children," 1108, and Chapman et al., "Predicting Language Production," 342. In their research on production, Chapman and colleagues excluded children with moderate hearing loss and found no effect for hearing on grammatical morpheme production in children and adolescents with DS. Robin S. Chapman et al., Language Skills of Children and Adolescents with Down Syndrome: II. Production Deficits," *JSLHR* 41, no. 4 (1998): 11. Contrarily, Laws and Hall included those with moderate to severe hearing loss and found more significant effects for hearing loss on language measurements. Laws and Hall, "Early Hearing Loss," 339. Similarly, Miolo and colleagues did not exclude participants based on the severity of hearing loss and found hearing loss to account for 23 percent variance in comprehension of grammatical morphemes. Miolo, Chapman, and Sindberg, "Sentence Comprehension," 183.

[30] Rates of prevalence represented in the following studies vary from 43 to 56 percent. C. Stoll et al., "Study of Down Syndrome in 238,942 Consecutive Births," *Annales de Genetique*, 41, no. 1 (1998): 48; Michel Emile Weijerman et al., "Prevalence of Congenital Heart Defects and Persistent Pulmonary Hypertension of the Neonate with Down Syndrome," *European Journal of Pediatrics* 169, no. 10 (2010): 1195–99; Sallie B. Freeman et al., "Ethnicity, Sex, and the Incidence of Congenital Heart Defects: A Report from the National Down Syndrome Project," *Genetics in Medicine* 10, no. 3 (2008): 175; D. Paladini et al., "The Association between Congenital Heart Disease and Down Syndrome in Prenatal Life," *Ultrasound in Obstetrics and Gynecology* 15, no. 2 (2000): 107; Claudine P. Torfs and Roberta E. Christianson, "Anomalies in Down Syndrome Individuals in a Large Population-Based Registry," *American Journal of Medical Genetics* 77, no. 5 (1998): 435; Gretchen L. Wells et al., "Congenital Heart Disease in Infants with Down's Syndrome," *Southern Medical Journal* 87, no. 7 (1994): 724–27; Sallie B. Freeman et al., "Population-Based Study of Congenital Heart Defects in Down Syndrome," *American*

not have an impact on cognitive abilities, other research demonstrates that CHD can have a negative impact on cognitive and linguistic outcomes, especially in the preschool years.[31] Research shows that CHD may contribute to variation in language delay and language acquisition in children with DS.[32] It is important to note that research in the TD population among children with CHD show a wide variety of mediating factors which affect cognitive, linguistic, and other neurodevelopmental outcomes, prime among which may be "abnormal oxygenation and low blood flow in utero, after birth, and around the time of surgery."[33]

Journal of Medical Genetics 80, no. 3 (1998): 213–17.

[31] For research demonstrating no impact, see Carla M. Startin et al., "Health Comorbidities and Cognitive Abilities across the Lifespan in Down Syndrome," *Journal of Neurodevelopmental Disorders* 12, no. 1 (2020): 10, and Tracie C. Rosser et al., "Associations between Medical History, Cognition, and Behavior in Youth with Down Syndrome: A Report from the Down Syndrome Cognition Project," *American Journal on Intellectual and Developmental Disabilities* 123, no. 6 (2018): 10–11. Tarek Alsaied and colleagues found negative effects from CHD through the preschool years, but by school years those negative effects had vanished. Tarek Alsaied et al., "Does Congenital Heart Disease Affect Neurodevelopmental Outcomes in Children with Down Syndrome?," *Congenital Heart Disease* 11, no. 1 (2016): 26–33. Jeannie Visootsak and colleagues found significant delays in motor, cognitive, and language measures for 12–14-month-old toddlers with CHD. Jeannie Visootsak et al., "Influence of Congenital Heart Defect on Psychosocial and Neurodevelopmental Outcomes in Children with Down Syndrome," *Cardiology in the Young* 26, no. 2 (2016): 1–13. See also Visootsak et al., "Neurodevelopmental Outcomes," 2688–91 for less statistically significant delays.

[32] Jeannie Visootsak et al., "Effect of Congenital Heart Defects on Language Development in Toddlers with Down Syndrome," *JIDR* 57, no. 9 (2013): 890–91.

[33] Tamara Gibb, "Neurocognitive Disability Is a Long-Term Consequence of Congenital Heart Surgery," *Neurology Reviews* 17, no. 1 (2009): 10. Other mediating factors include wait time until surgery, methods of vital organ support during surgery, and length of hospital stay. Jennifer M. Lynch et al., "Time to Surgery and Preoperative Cerebral Hemodynamics Predict Postoperative White Matter Injury in Neonates with Hypoplastic Left Heart Syndrome," *Journal of Thoracic and Cardiovascular Surgery* 148, no. 5 (2014): 2181–88; William T. Mahle et al., "Relationship of Surgical Approach to Neurodevelopmental Outcomes in Hypoplastic Left Heart Syndrome," *Pediatrics* 117, no. 1 (2006): e90–e97; David C. Bellinger et al., "Neurodevelopmental Status at Eight Years in Children with Dextro-Transposition of the Great Arteries: the Boston Circulatory Arrest Trial," *Journal of Thoracic and Cardiovascular Surgery* 126, no. 5 (2003): 1385–96; William T. Mahle and Gil Wernovsky, "Long-Term Developmental Outcome of Children with Complex Congenital Heart Disease," *Clinics in Perinatology* 28, no. 1 (2001): 235–47; David C Bellinger et al., "Developmental and Neurological Status of Children at 4 Years of Age after Heart Surgery with Hypothermic Circulatory Arrest or Low-Flow Cardiopulmonary Bypass," *Circulation* 100, no. 5 (1999): 526–32.

Vision impairment. Children with DS are at an increased risk for a number of ocular disorders such as refractive errors, nystagmus, astigmatism, and cataracts, among many others.[34] While many ophthalmic disorders result in impaired vision, some, such as slanting fissures, epicanthic folds, Brushfield spots, hypertelorism, and epiblepharon do not.[35] Vision impairments increase with age, and by the ages of five to twelve years, as many as 80 percent of children with DS may experience some type of ophthalmological disorder.[36] Tuomo Määttä and colleagues found vision impairment to be most common in individuals with DS with severe to profound cognitive disability, suggesting that poor vision is associated with cognitive impairment.[37] Additionally, visual impairment in individuals with DS has negative effects on adaptive behavior.[38] Many of the negative

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[34] Lisbeth Sandfeld Nielsen, Hanne Jensen, and Liselotte Skov, "Risk Factors of Ophthalmic Disorders in Children with Developmental Delay," *Acta Ophthalmologica* 86, no. 8 (2008): 879–81; Alexandra L. Creavin and Ray D. Brown, "Ophthalmic Abnormalities in Children with Down Syndrome," *Journal of Pediatric Ophthalmology & Strabismus* 46, no. 2 (2009): 76–82; Branka Stirn Kranjc, "Ocular Abnormalities and Systemic Disease in Down Syndrome: Retrospective Clinical Study, University Eye Hospital, Ljubljana, Slovenia," *Strabismus* 20, no. 2 (2012): 74–77; Elma Stephen et al., "Surveillance of Vision and Ocular Disorders in Children with Down Syndrome," *Developmental Medicine & Child Neurology* 49, no. 7 (2007): 513–15; Siegfried Pueschel and Stefan Gieswein, "Ocular Disorders in Children with Down Syndrome," *DSRP* 1, no. 3 (1993): 129–32.

[35] Creavin and Brown, "Ophthalmic Abnormalities," 77.

[36] Nancy J. Roizen and David Patterson, "Down's Syndrome," *The Lancet* 361, no. 9365 (2003): 1283.

[37] Tuomo Määttä et al., "Sensory Impairments and Health Concerns Related to the Degree of Intellectual Disability in People with Down Syndrome," *DSRP* 11, no. 2 (2006): 81. The study demonstrates that visual impairment was significantly related to intellectual disability in individuals with DS. Drawing upon their findings and previous findings, the authors suggest that poor vision may contribute to cognitive impairment. They also recognize that the relationship of impaired vision to cognition depends upon the type of visual impairment and that in some cases glasses can help to remedy the deficit in vision. See also Jacques Van Splunder et al., "Refractive Errors and Visual Impairment in 900 Adults with Intellectual Disabilities in the Netherlands," *Acta Ophthalmologica Scandinavica* 81, no. 2 (2003): 123–30; H. M. Evenhuis et al., "Prevalence of Visual and Hearing Impairment in a Dutch Institutionalized Population with Intellectual Disability," *JIDR* 45, no. 5 (2001): 457–64; H. M. J. Van Schrojenstein Lantman-de Valk et al., "The Need for Assessment of Sensory Functioning in Ageing People with Mental Handicap," *JIDR* 38, no. 3 (1994): 289–98.

[38] Christine de Weger, F. Nienke Boonstra, and Jeroen Goossens, "Differences between Children with Down Syndrome and Typically Developing Children in Adaptive Behaviour, Executive Functions and Visual Acuity," *Scientific Reports* 11, no. 1 (2021): 10; A. Fyd et al., "632. Early

effects of vision impairment may be reduced through early recognition and correction (such as glasses), thus surveillance and early recognition is vital as it may "lead to improved developmental and functional outcomes for children with Down syndrome."[39]

Weak muscle tone. Hypotonia, or weak muscle tone, is present in virtually all individuals with DS, and is a contributing factor to the delay of motor development in infants and children with DS.[40] Additionally, hypotonia "affects lip and tongue movements involved in all aspects of speech production," and has been found to contribute to speech intelligibility difficulties in individuals with DS.[41]

Oral-motor structure and function. Hypotonia is only one of several factors which contribute to reduced oral-motor function.[42] Other abnormal oral structures in individuals with DS which may affect speech include "a small oral cavity, a narrow, high arched palate, irregular dentition," and enlarged tonsils and adenoids.[43] Such

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Intervention of Visual Impairment May Protect Adaptive Behaviour in Down Syndrome?," *Archives of Disease in Childhood* 97, no. Suppl 2 (2012): A183.

[39] Stephen et al., "Surveillance of Vision," 515. See also Määttä et al., "Sensory Impairments," 81.

[40] Jeannie Visootsak et al., "Neurodevelopmental Outcomes in Children with Down Syndrome and Congenital Heart Defects," *American Journal of Medical Henetics Part A* 155, no. 11 (2011): 2688; Ira T. Lott, "Neurological Phenotypes for Down Syndrome across the Life Span," *Progress in Brain Research* 197 (2012): 3.

[41] Stoel-Gammon, "Down Syndrome Phonology," 94; Barbara Dodd and Lynda Thompson, "Speech Disorder in Children with Down's Syndrome," *JIDR* 45, no. 4 (2001): 309; Leonard Abbeduto, Steven F. Warren, and Frances A. Conners, "Language Development in Down Syndrome: From the Prelinguistic Period to the Acquisition of Literacy," *Mental Retardation and Developmental Disabilities Research Reviews* 13, no. 3 (2007): 249. It should be noted that this connection is clinical, and not supported by experimental data. Shin Ying Chu and Steven M. Barlow, "A Call for Biomechanics to Understand Hypotonia and Speech Movement Disorders in Down Syndrome," *Advances in Communication Disorder* 16, no. 1 (2016): 24–26.

[42] Elizabeth F. Barnes et al., "A Comparison of Oral Structure and Oral-Motor Function in Young Males with Fragile X Syndrome and Down Syndrome," *JSLHR* 49 (2006): 904.

[43] Joanne E. Roberts, Johanna Price, and Cheryl Malkin, "Language and Communication Development in Down Syndrome," *Mental Retardation and Developmental Disabilities Research*

abnormalities are thought to contribute to "reduced speed, range of motion, and coordination of the articulators," and thus reduced speech intelligibility.[44] Though it was previously thought that individuals with DS had large tongues which resulted in speech difficulties, it seems rather that the reduced size of the oral cavity makes the tongue relatively large in comparison.[45] Boys with DS have been shown to have atypical lips, tongue, and velopharyngeal structure which contributed to reduced oral function, particularly in the movement and control of the lips, tongue, and jaw, as well as reduced speech function.[46]

Sleep disturbances. Individuals with DS are at an increased risk of suffering a variety of sleep disturbances, which can affect their physical, cognitive, behavioral, and linguistic development.[47] Medical complexities experienced by individuals with DS, such as "cardiac complications, airway, pulmonary, and hearing problems, hematologic, autoimmune, oncologic, and musculoskeletal disorders," obesity, and enlarged tonsils, among others, can cause individuals with DS to be more prone to sleep problems.[48]

Reviews 13, no. 1 (2007): 27; Abbeduto, Warren, and Conners, "Language Development," 249; Barnes et al., "A Comparison of Oral Structure," 904.

[44] Gary E. Martin et al., "Language Characteristics of Individuals with Down Syndrome," *Topics in Language Disorders* 29, no. 2 (2009): 3; Roberts, Price, and Malkin, "Language and Communication Development," 27; Abbeduto, Warren, and Conners, "Language Development," 249.

[45] Ray D. Kent and Houri K. Vorperian, "Speech Impairment in Down Syndrome: A Review," *Journal of Speech and Language Hearing Research* 56 no. 1 (2013): 10; Abbeduto, Warren, and Conners, "Language Development," 249.

[46] Barnes et al., "A Comparison of Oral Structure," 912. While these characteristics may be present in girls with DS as well, this study was conducted only on boys.

[47] Elisa Fucà et al., "Characterization of Sleep Disturbances in Children and Adolescents with Down Syndrome and Their Relation with Cognitive and Behavioral Features," *International Journal of Environmental Research and Public Health* 18, no. 9 (2021): 1.

[48] Fucà et al., "Characterization of Sleep Disturbances," 1; Chia-Fan Lee et al., "Prevalence of Obstructive Sleep Apnea in Children with Down Syndrome: A Meta-Analysis," *Journal of Clinical Sleep Medicine* 14, no. 5 (2018): 873; Shervin S. Churchill et al., "Sleep Measurement and Monitoring in Children with Down Syndrome: A Review of the Literature, 1960–2010," *Sleep Medicine Reviews* 16, no.

Approximately two-thirds of children with DS suffer from obstructive sleep apnea (OSA).[49] While OSA can affect infants and children of all ages, moderate-to-severe OSA seems to be more prevalent in younger years.[50] In addition to OSA, a high prevalence of other sleep problems such as bedtime resistance, sleep anxiety, night waking, parasomnias, sleep disordered breathing, day-time sleepiness, disorders in initiating and maintaining sleep, disorders of arousal, sleep–wake transition disorders, reduced REM sleep, and increased slow-wave sleep exist among children with DS.[51]

In the DS population, sleep disturbances have been found to be predictive of attention-deficit/hyperactivity problems.[52] Additionally, sleep disturbances have a negative impact on visual-motor integration, externalized behavior (increased irritability/agitation/crying, and noncompliance), internalized behavior (anxiety/depression), the accomplishment of daily activities, communication skills, inhibition, visuoperceptual skills, and cognitive flexibility.[53] Finally, in relation to

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5 (2012): 2.

[49] Lee et al., "Prevalence of Obstructive Sleep Apnea," 871; Mieke Maris et al., "Prevalence of Obstructive Sleep Apnea in Children with Down Syndrome," *Sleep* 39, no. 3 (2016): 702.

[50] Lee et al., "Prevalence of Obstructive Sleep Apnea," 871–73; Maris et al., "Prevalence of Obstructive Sleep Apnea," 702.

[51] Melanie Carter et al., "Sleep Problems in a Down Syndrome Population," *Archives of Disease in Childhood* 94, no. 4 (2009): 308–10; Fucà et al., "Characterization of Sleep Disturbances," 5; Lauren C. Nisbet et al., "Characterization of a Sleep Architectural Phenotype in Children with Down Syndrome," *Sleep and Breathing* 19, no. 3 (2015): 1065–71; Asaf Levanon, Ariel Tarasiuk, and Asher Tal, "Sleep Characteristics in Children with Down Syndrome," *Journal of Pediatrics* 134, no. 6 (1999): 755–60.

[52] Igor A. Kelmanson, "Sleep Disturbances, Behavioural Problems and Adaptive Skills in Children with Down's Syndrome," *Early Child Development and Care* 187, no. 11 (2017): 1679–93; Fucà et al., "Characterization of Sleep Disturbances," 9. Contrarily, Ashworth and colleagues did not find a strong relationship between sleep and performance on continuous performance attention tasks in children with DS. Anna Ashworth et al., "The Importance of Sleep: Attentional Problems in School-Aged Children with Down Syndrome and Williams Syndrome," *Behavioral Sleep Medicine* 13, no. 6 (2015): 468.

[53] Fucà et al., "Characterization of Sleep Disturbances," 9–10; Shervin S. Churchill et al., "Relationship between Sleep Disturbance and Functional Outcomes in Daily Life Habits of Children with Down Syndrome," *Sleep* 38, no. 1 (2015): 61–71; Gillian M. Nixon et al., "The Relationship between Sleep-Disordered Breathing Severity and Daytime Adaptive Functioning in Children with Down

language, poor sleep has a significant negative effect on expressive language (vocabulary and syntax) in preschoolers with DS and verbal IQ in school-aged children, and contributes to poor verbal fluency in adolescents and young adults.[54]

Cognitive Development

Though many generalities can be made regarding the cognitive phenotype of individuals with DS, vast differences exist among the cognitive profiles of individuals with DS, beginning in infancy and persisting into late adulthood.[55] Differences between the brains of children with DS and TD children are present from birth, or shortly before. While earlier studies indicated that the brain of a newborn with DS is relatively normal, more recent studies indicate that this is not so, with differences in the DS brain emerging as early as 22 weeks gestational age and increasing thereafter, particularly after birth.[56]

Syndrome," *CNS Neuroscience and Therapeutics* 22, no. 11 (2016): 937; C.-C. JJ Chen, G. Spanò, and Jamie O. Edgin, "The Impact of Sleep Disruption on Executive Function in Down Syndrome," *RDD* 34, no. 6 (2013): 2037–38; G. Andreou et al., "Cognitive Status in Down Syndrome Individuals with Sleep Disordered Breathing Deficits (SDB)," *Brain and Cognition* 50, no. 1 (2002): 48; Jennifer Breslin et al., "Obstructive Sleep Apnea Syndrome and Cognition in Down Syndrome," *Developmental Medicine & Child Neurology* 56, no. 7 (2014): 662.

[54] Jamie O. Edgin et al., "Sleep Disturbance and Expressive Language Development in Preschool-age Children with Down Syndrome," *Child Development* 86, no. 6 (2015): 12–13; Breslin et al., "Obstructive Sleep Apnea," 662; Chen, Spanò, and Edgin, "The Impact of Sleep Disruption," 2036–37.

[55] Karmiloff-Smith et al., "The Importance of Understanding Individual Differences," 5; Michael S. C. Thomas et al., "A Multi-Level Developmental Approach to Exploring Individual Differences in Down Syndrome: Genes, Brain, Behaviour, and Environment," *RDD* 104 (2020): 3; R. Tsao and C. Kindelberger, "Variability of Cognitive Development in Children with Down Syndrome: Relevance of Good Reasons for Using the Cluster Procedure," *RDD* 30, no. 3 (2009): 431–32.

[56] Karmiloff-Smith et al., "The Importance of Understanding Individual Differences," 4–5; Lynn Nadel, "Down's Syndrome: A Genetic Disorder in Biobehavioral Perspective," *Genes, Brain and Behavior* 2, no. 3 (2003): 158; For studies indicating that the brains of babies with DS are nearly indistinguishable from TD babies, see Osnat Bar-Peled et al., "Developmental Pattern of Muscarinic Receptors in Normal and Down's Syndrome Fetal Brain—An Autoradiographic Study," *Neuroscience Letters* 133, no. 2 (1991): 154–58; B. W. L. Brooksbank, D. Walker, and R. Balazs, "Neuronal Maturation in the Foetal Brain in Down's Syndrome," *Early Human Development* 18, no. 4 (1989): 237–46; K. E. Wisniewski and B. Schmidt-Sidor, "Postnatal Delay of Myelin Formation in Brains from Down Syndrome Infants and Children," *Clinical Neuropathology* 8, no. 2 (1989): 55–62. For research providing evidence that prenatal brains differ, see Prachi A. Patkee et al., "Neurometabolite Mapping Highlights Elevated Myo-Inositol Profiles within the Developing Brain in Down Syndrome," *Neurobiology of Disease* 153

These often-subtle early brain differences contribute to cognitive impairment in children with DS.[57]

Unlike the considerable variability of the presence of phenotypic physical features and physical impairments, cognitive impairment is present in all individuals with DS.[58] Despite the nearly universal presence of cognitive impairment in individuals with DS, cognitive ability among individuals with DS varies significantly, ranging from mild to profound impairment.[59] While the average IQ of individuals with DS is 50, IQs range

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(2021): 1–10; Prachi A. Patkee et al., "Early Alterations in Cortical and Cerebellar Regional Brain Growth in Down Syndrome: An *in vivo* Fetal and Neonatal MRI Assessment," *NeuroImage: Clinical* 25 (2020): 1–11; Makiko Imai et al., "Functional Connectivity of the Cortex of Term and Preterm Infants and Infants with Down's Syndrome," *Neuroimage* 85 (2014): 272–78; J. A. Golden and B. T. Hyman, "Development of the Superior Temporal Neocortex Is Anomalous in Trisomy 21," *Journal of Neuropathology and Experimental Neurology* 53, no. 5 (1994): 513–20; Krystyna E. Wisniewski and Elizabeth Kida, "Abnormal Neurogenesis and Synaptogenesis in Down Syndrome Brain," *Developmental Brain Dysfunction* 7, no. 6 (1994): 289–301; B. Schmidt-Sidor et al., "Brain Growth in Down Syndrome Subjects 15 to 22 Weeks of Gestational Age and Birth to 60 Months," *Clinical Neuropathology* 9, no. 4 (1990): 181–90; K. E. Wisniewski, "Down Syndrome Children Often Have Brain with Maturation Delay, Retardation of Growth, and Cortical Dysgenesis," *American Journal of Medical Genetics* 37, no. S7 (1990): 274–81; Jesús Flórez et al., "Autoradiographic Studies of Neurotransmitter Receptors in the Brain of Newborn Infants with Down Syndrome," *American Journal of Medical Genetics* 37, no. S7 (1990): 301–5.

[57] Ephrem Engidawork and Gert Lubec, "Molecular Changes in Fetal Down Syndrome Brain," *Journal of Neurochemistry* 84, no. 5 (2003): 895–904; Robert E. Mrak and W. Sue T. Griffin, "Trisomy 21 and the Brain," *Journal of Neuropathology & Experimental Neurology* 63, no. 7 (2004): 679–85.

[58] Julie R. Korenberg et al., "Down Syndrome Phenotypes," 4998; Jones, Jones, and del Campo Casanelles, *Smith's Recognizable Patterns*, 3; Mohammed Rachidi and Carmela Lopes, "Mental Retardation in Down Syndrome: From Gene Dosage Imbalance to Molecular and Cellular Mechanisms," *Neuroscience Research* 59, no. 4 (2007): 350. Though the vast majority of the literature identifies cognitive impairment as a characteristic present in all individuals with DS, there have been reports of a few individuals with DS with an IQ within the normal range. C. J. Epstein, "Down Syndrome," I:293.

[59] Tuomo Määttä et al., "Mental Health, Behaviour and Intellectual Abilities of People with Down Syndrome," *DSRP* 11, no. 1 (2006): 39. See John E. Rynders, "Promoting the Educational Competence of Students with Down Syndrome," in *Down Syndrome: A Review of Current Knowledge*, ed. Jean A. Rondal, Juan Perera, and Lynn Nadel (London: Whurr, 1999), 70, for an overview of IQ scores and levels of mental retardation across various studies.

from 30 to 70.[60] Mental age (MA), the mean intellectual performance of a given age, does not typically exceed 7 or 8 years of age in individuals with DS.[61]

Similar to physical development, the cognitive development of children with DS follows the same sequence as that of TD children, though occurring at widely varying rates.[62] In contrast to TD individuals, the IQ of individuals with DS progressively decreases with age, though not all domains of cognition are equally affected by this decline.[63] As opposed to TD children, the rate of development of children with DS slows

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[60] Robin S. Chapman and Linda J. Hesketh, "Behavioral Phenotype of Individuals with Down Syndrome," *Mental Retardation & Developmental Disabilities Research Reviews* 6, no. 2 (2000): 87; Julie Grieco et al., "Down Syndrome: Cognitive and Behavioral Functioning across the Lifespan," *American Journal of Medical Genetics Part C: Seminars in Medical Genetics*, 169, no. 2 (2015): 136; Andrea Contestabile, Fabio Benfenati, and Laura Gasparini, "Communication Breaks-Down: from Neurodevelopment Defects to Cognitive Disabilities in Down Syndrome," *Progress in Neurobiology* 91, no. 1 (2010): 2. A slightly different average (44.7), and broader range (28 to 71) was reported by Stefano Vicari and colleagues in their study of fifty-six Italian individuals with DS, Stefano Vicari et al., "Neuropsychological Profile of Italians with Williams Syndrome: An Example of a Dissociation between Language and Cognition?," *Journal of the International Neuropsychological Society* 10, no. 6 (2004): 865. Additionally, Floriana Costanza and colleagues reported individuals with DS with an IQ as high as 83. Floriana Costanzo et al., "Executive Functions in Intellectual Disabilities: A Comparison between Williams Syndrome and Down Syndrome," *RDD* 34, no. 5 (2013): 1772. While such variations may be due in part to differing measurement of IQ, these deviations from the recognized range of IQ in individuals with DS reinforces the vast variability of cognitive abilities in individuals with DS.

[61] For the definition of mental age, see Grieco et al., "Down Syndrome," 19. For information on the mean age of individuals with DS, see David Gibson, *Down's Syndrome: The Psychology of Mongolism* (Cambridge: Cambridge University Press, 1978), 46; Stefano Vicari, "Motor Development and Neuropsychological Patterns in Persons with Down Syndrome," *Behavior Genetics* 36, no. 3 (2006): 356; Bruce F. Pennington et al., "The Neuropsychology of Down Syndrome: Evidence for Hippocampal Dysfunction," *Child Development* 74, no. 1 (2003): 77.

[62] Chapman and Hesketh, "Behavioral Phenotype," 87; Dante Cicchetti and Marjorie Beeghly, *Symbolic Development in Atypical Children*, New Directions for Child Development, No. 36 (San Francisco: Jossey-Bass, 1987), 6. Typically, children with DS take about twice as long to gain a month in MA, so that one month in MA takes two chronological months to reach. Penny Hauser-Cram et al., *Children with Disabilities: A Longitudinal Study of Child Development and Parent Well-Being*, Monographs of the Society for Research in Child Development (Boston: Blackwell, 2001), 81; Robert B. Reed et al., "Interrelationships of Biological, Environmental and Competency Variables in Young Children with Down Syndrome," *Applied Research in Mental Retardation* 1, no. 3 (1980): 165–66. Though the trajectory of cognitive development in children with DS seems to follow the same pattern as that of TD developing children, there is emerging evidence that the DS brain may actually have an atypical neural trajectory. Taralee Hamner et al., "Pediatric Brain Development in Down Syndrome: A Field in Its Infancy," *Journal of the International Neuropsychological Society* 24, no. 9 (2018): 10.

[63] Pennington et al., "The Neuropsychology of Down Syndrome," 77; Vicari et al.,

over time. This deceleration of intellectual growth begins in infancy, slowing noticeably after the first year.[64] The progressive decrease in IQ, then, is caused not by a loss of skills, but rather a slowing of the rate of development in comparison to TD children.[65] As the rate of their development lags behind that of their TD peers, children with DS assume a gradual decline in MA relative to their chronological age (CA) overtime.[66] Though the IQ measurement declines, raw scores continue to increase throughout childhood and into

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"Neuropsychological Profile of Italians," 870; Vicari, "Motor Development and Neuropsychological Patterns," 356; Tess Patterson, Charlene M. Rapsey, and Paul Glue, "Systematic Review of Cognitive Development across Childhood in Down Syndrome: Implications for Treatment Interventions," *JIDR* 57, no. 4 (2013): 309–10; Janet Carr, "Six Weeks to 45 Years: A Longitudinal Study of a Population with Down Syndrome," *Journal of Applied Research in Intellectual Disabilities* 25, no. 5 (2012): 416. Marian Sigman and Ellen Ruskin, "Continuity and Change in the Social Competence of Children with Autism, Down Syndrome, and Developmental Delays," *Monographs of the Society for Research in Child Development* 64, no. 1 (1999): 25–28; Pennington and colleagues found that the dysfunction in the DS brain is primarily hippocampal dysfunction rather than prefrontal dysfunction, or generalized dysfunction. They found no decline with age for prefrontal functions. Pennington et al., "The Neuropsychology of Down Syndrome," 89–90.

[64] Hodapp and Zigler, "Applying the Developmental Perspective," 16; Marchal et al., "Growing up with Down Syndrome," 442; John Corbitt, "Is Down Syndrome a Progressive Syndrome?," *Journal of the Royal Society of Medicine* 78 (1985): 499–502; M. J. Dicks-Mireaux, "Mental Development of Infants with Down's Syndrome," *American Journal of Mental Deficiency* 77, no. 1 (1972): 26–32; Lawrence E. Dameron, "Development of Intelligence of Infants with Mongolism," *Child Development* 34, no. 3 (1963): 733–38.

[65] Hauser-Cram et al., *Children with Disabilities*, 7; Donna Couzens, Monica Cuskelly, and Michele Haynes, "Cognitive Development and Down Syndrome: Age-Related Change on the Stanford-Binet Test," *American Journal on Intellectual and Developmental Disabilities* 116, no. 3 (2011): 182. For an overview of the range and trajectory of intellectual development in children with DS, see Robert M. Hodapp, David W. Evans, and F. Lee Gray, "Intellectual Development in Children with Down Syndrome," in Rondal, Perera, and Nadel, *Down Syndrome: A Review of Current Knowledge*, 124–32.

[66] Robert M. Hodapp and Edward Zigler, "Applying the Developmental Perspective to Individuals with Down Syndrome," in *Children with Down Syndrome: A Developmental Perspective*, ed. Dante Cicchetti and Marjorie Beeghly (New York: Cambridge University Press, 1990), 16.

adolescence.[67] However, by early adulthood individuals with DS generally begin to experience a downward trajectory in raw score on many measurements.[68]

Intellectual decline of individuals with DS continues into adulthood and for many is exacerbated by early-onset Alzheimer's.[69] Individuals with DS are at an increased risk of developing Alzheimer's, which typically develops two to three decades earlier in individuals with DS than when compared to the general population.[70] By the age of forty nearly all individuals with DS present neuropathological markers associated with Alzheimer's, and by the age of sixty-five, as many as 80 percent of individuals with DS may develop dementia.[71] In addition to memory loss, Alzheimer's in individuals with

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[67] Patterson, Rapset, and Glue, "Systematic Review of Cognitive Development," 311; Couzens, Cuskelly, and Haynes, "Cognitive Development and Down Syndrome," 181–204; Lynette V. Roberts and Jenny L. Richmond, "Preschoolers with Down Syndrome Do Not Yet Show the Learning and Memory Impairments Seen in Adults with Down Syndrome," *Developmental Science* 18, no. 3 (2015): 4055; Tsao and Kindelberger, "Variability of Cognitive Development," 427–28. Though the general trend is for scores to increase into adolescence and early adulthood, Tsao and Kindelberger found that many children stagnated on most measurements by the age of ten or eleven. Tsao and Kindelberger, "Variability of Cognitive Development," 431.

[68] Couzens, Cuskelly, and Haynes, "Cognitive Development and Down Syndrome," 196–99.

[69] Alick Bush and Nigel Beail, "Risk Factors for Dementia in People with Down Syndrome: Issues in Assessment and Diagnosis," *AJMR* 109, no. 2 (2004): 90–92; Frank R. Brown et al., "Intellectual and Adaptive Functioning in Individuals with Down Syndrome in Relation to Age and Environmental Placement," *Pediatrics* 85, no. 3 (1990): 450–52; D. A. Devenny et al., "Sequence of Cognitive Decline in Dementia in Adults with Down's Syndrome," *JIDR* 44, no. 6 (2000): 654–65; Mary Godfrey and Nancy Raitano Lee, "Memory Profiles in Down Syndrome across Development: A Review of Memory Abilities through the Lifespan," *Journal of Neurodevelopmental Disorders* 10, no. 1 (2018): 2; Grieco et al., "Down Syndrome," 136. It should be noted, however, that not all adults with DS experience a marked decline in cognition. Chris Oliver et al., "A Four Year Prospective Study of Age-Related Cognitive Change in Adults with Down's Syndrome," *Psychological Medicine* 28, no. 6 (1998): 1375. Carr's study showed mixed results, with a relatively stable, though not significant decline, in the IQ of adults with DS, though a much sharper decline for those with Alzheimer's. Carr, "Six Weeks to 45 Years," 414–22.

[70] Frances K. Wiseman et al., "A Genetic Cause of Alzheimer Disease: Mechanistic Insights from Down Syndrome," *Nature Reviews Neuroscience* 16, no. 9 (2015): 3; Clive Ballard et al., "Dementia in Down's Syndrome," *The Lancet Neurology* 15, no. 6 (2016): 622–36; K. E. Wisniewski, H. M. Wisniewski, and G. Y. Wen, "Occurrence of Neuropathological Changes and Dementia of Alzheimer's Disease in Down's Syndrome," *Annals of Neurology: Official Journal of the American Neurological Association and the Child Neurology Society* 17, no. 3 (1985): 278–82.

[71] Ira T. Lott and Elizabeth Head, "Alzheimer Disease and Down Syndrome: Factors in Pathogenesis," *Neurobiology of Aging* 26, no. 3 (2005): 383–89; M. McCarron et al., "A Prospective 14-

DS causes a marked decline in adaptive behavior, visuospatial organization, verbal abilities, new learning abilities, and changes in personality and behavior.[72]

Short-term and working memory. Short-term memory and working memory have traditionally been viewed as two distinct, though possibly interrelated constructs, with short-term memory referring to simple temporary storage of information while working memory involves the short-term capacity to maintain and manipulate information.[73] VSTM is generally measured by immediate serial recall tasks such as the forward digit span or nonword repetition in which one repeats back a series of numbers or nonsense words in the same order presented, while verbal working memory is often measured by more complex tasks that require manipulating information, such as a backward the digit span in which one must "(recall) lists of digits in the reverse order of

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year Longitudinal Follow-up of Dementia in Persons with Down Syndrome," *JIDR* 58, no. 1 (2014): 4; Wiseman et al., "A Genetic Cause of Alzheimer Disease," 3. The actual percentage of individuals who develop dementia is extremely challenging to quantify, and percentages vary widely, due in part to the experimental design variation and in part to the many overlapping features of Alzheimer's and DS. Contestabile, Benfaniti, and Gasparini, "Communication Breaks-Down," 3; Bush and Beail, "Risk Factors for Dementia," 89–90.

[72] For memory loss see S. J. Krinsky-McHale, D. A. Devenny, and W. P. Silverman, "Changes in Explicit Memory Associated with Early Dementia in Adults with Down's Syndrome," *JIDR* 46, no. 3 (2002): 198–208; Oliver et al., "A Four Year Prospective," 1365–77. For adaptive behavior see Warren B. Zigman et al., "Incidence and Temporal Patterns of Adaptive Behavior Change in Adults with Mental Retardation," *AJMR* 107, no. 3 (2002): 169. For visuospatial organization and verbal abilities, see Devenny et al., "Sequence of Cognitive Decline," 661–62. For learning see Oliver et al., "A Four Year Prospective," 1365–77. For personality and behavior, see Sarah L. Ballet al., "Executive Dysfunction and its Association with Personality and Behaviour Changes in the Development of Alzheimer's Disease in Adults with Down Syndrome and Mild to Moderate Learning Disabilities," *British Journal of Clinical Psychology* 47, no. 1 (2008): 1–29, and Sarah L. Ball et al., "Personality and Behaviour Changes Mark the Early Stages of Alzheimer's Disease in Adults with Down's Syndrome: Findings from a Prospective Population-Based Study," *International Journal of Geriatric Psychiatry: A Journal of the Psychiatry of Late Life and Allied Sciences* 21, no. 7 (2006): 661–73.

[73] Alan Baddeley and Christopher Jarrold, "Working Memory and Down Syndrome," *JIDR* 51, no. 12 (2007): 925; Bart Aben, Sven Stapert, and Arjan Blokland, "About the Distinction between Working Memory and Short-Term Memory," *Frontiers in Psychology* 3 (2012): 1; Christopher Jarrold and Alan Baddeley, "Short-Term Memory in Down Syndrome: Applying the Working Memory Model," *DSRP* 7, no. 1 (2001): 17.

presentation," among many other tasks.[74] However, the constructs are not as clear-cut as they may seem, and are often used ambiguously in research.[75] Though much research treats short-term memory and working memory as two separate constructs, they are here considered together, since this is a very broad overview of memory in the DS population.[76]

Short-term and working memory are foundational for thinking and learning.[77] Individuals with DS have deficits in working memory, though not all parts of working memory are equally impaired.[78] Of particular interest in the DS population are the differences between verbal (phonological) memory and visuospatial memory. Verbal memory is controlled by the phonological loop which is hypothesized to "maintain and manipulate speech-based material," while visuospatial memory, controlled by the visuospatial sketchpad, is the ability to "(hold) and (manipulate) visual and spatial

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[74] Catherine Demoulin and Régine Kolinsky, "Does Learning to Read Shape Verbal Working Memory?," *Psychonomic Bulletin and Review* 23, no. 3 (2016): 704.

[75] Aben and colleagues offer a helpful review of the use of the two constructs and the ambiguity of their use in research. Aben, Stapert, and Blokland, "About the Distinction," 1–9.

[76] For a similar approach see Demoulin and Kolinsky, "Does Learning to Read Shape Verbal Working Memory?," 704. In the DS literature, VSTM is often referred to as a sub-set of working memory, thus complicating the disentanglement of the two. For example, Lanfranchi and colleagues measured verbal working memory on a continuum, with the lowest amount of control required being forward word recall. Silvia Lanfranchi, Cesare Cornoldi, and Renzo Vianello, "Verbal and Visuospatial Working Memory Deficits in Children with Down Syndrome," *AJMR* 109, no. 6 (2004): 458–59. However, forward word recall does not require manipulation of the information in any way and thus may be viewed as a measurement of VSTM. See also Renata Nacinovich et al., "Cognitive Development and Adaptive Functions in Children with Down Syndrome at Different Developmental Stages," *Journal of Psychopathology Online First* (March 2021): 5; Baddeley and Jarrold, "Working Memory," 925–31; Stefano Vicari and Giovanni Augusto Carlesimo, "Short-Term Memory Deficits Are Not Uniform in Down and Williams Syndromes," *Neuropsychology Review* 16, no. 2 (2006): 89–90.

[77] Nelson Cowan et al., "On the Capacity of Attention: Its Estimation and its Role in Working Memory and Cognitive Aptitudes," *Cognitive Psychology* 51, no. 1 (2005): 1–2; Jarrold and Baddeley, "Short-Term Memory," 19; Baddeley and Jarrold, "Working Memory," 925.

[78] For a review of the literature, see Baddeley and Jarrold, "Working Memory," 925–31.

information."[79] Individuals with DS have clear deficits in verbal short-term memory.[80] Such a deficit means that the ability for individuals with DS to successfully recall spoken information is impaired, often measured by asking participants to recall a series of digits presented to them verbally.[81] This impairment of VSTM seems to be a unique feature of DS associated with the phonological loop, for when compared to several varieties of control groups on VSTM tasks, individuals with DS consistently perform lower than the control group.[82] The impairment in VSTM carries over into verbal working memory, as the difficulties experienced by individuals with DS to complete verbal memory tasks increases as the amount of control to complete the task increases. Lanfranchi and

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[79] Baddeley and Jarrold, "Working Memory," 925–26. The phonological loop also has the capacity "to convert a visual stimulus, such as a printed word, into a phonological representation by subvocal naming" (926).

[80] Nacinovich et al., "Cognitive Development," 5; Vicari and Carlesimo, "Short-Term Memory Deficits," 87–94; S. Vicari, A. Carlesimo, and C. Caltagirone, "Short-Term Memory in Persons with Intellectual Disabilities and Down's Syndrome," *JIDR* 39, no. 6 (1995): 532–37; Rachel F. Hick, Nicola Botting, and Gina Conti-Ramsden, "Short-Term Memory and Vocabulary Development in Children with Down Syndrome and Children with Specific Language Impairment," *Developmental Medicine and Child Neurology* 47, no. 8 (2005): 536; Christopher Jarrold, Alan D. Baddeley, and Caroline E. Phillips, "Verbal Short-Term Memory in Down Syndrome: A Problem of Memory, Audition, or Speech?," *JSLHR* 45 (2002): 531–44.

[81] This method of assessment is called digit span. When assessed using digit span, participants with DS consistently perform lower than developmentally matched peers. Baddeley and Jarrold, "Working Memory," 927. For example, see Elizabeth Kay-Raining Bird and Robin S. Chapman, "Sequential Recall in Individuals with Down Syndrome," *Journal of Speech and Hearing Research* 37, no. 6 (1994): 1369–80; Hye-Kyeung Seung and Robin Chapman, "Digit Span in Individuals with Down Syndrome and in Typically Developing Children: Temporal Aspects," *JSLHR* 43, no. 3 (2000): 609–20. Similar results have been found when assessing children with DS using word length experiments and sentence length experiments. K. Kanno and Y. Ikeda, "Word-Length Effect in Verbal Short-Term Memory in Individuals with Down's Syndrome," *JIDR* 46, no. 8 (2002): 613–18; H.-K. Seung and R. Chapman, "Sentence Memory of Individuals with Down's Syndrome and Typically Developing Children," *JIDR* 48, no. 2 (2004): 160–71.

[82] Baddeley and Jarrold, "Working Memory," 927–29; Jarrold and Baddeley, "Short-Term Memory," 18–19; Robin Chapman, "Language Learning in Down Syndrome: The Speech and Language Profile Compared to Adolescents with Cognitive Impairment of Unknown Origin," *DSRP* 10, no. 2 (2006): 63. However, though an impairment in the phonological loop is the prevailing hypothesis for the underlying cause of a VSTM deficit in individuals with DS, Vicari and colleagues found no evidence of impairment of the phonological loop and instead propose an impairment of central-executive functioning as the underlying cause of impaired VSTM. S. Vicari, L. Marotta, and G. A. Carlesimo, "Verbal Short-Term Memory in Down's Syndrome: An Articulatory Loop Deficit?," *JIDR* 48, no. 2 (2004): 80–92.

colleagues found that as the complexity of the verbal memory task increased, the degree of difference between the children with DS and the MA-matched control group also increased.[83]

Despite the challenges individuals with DS face in many areas of cognition and memory, the visuospatial component of short-term memory is relatively well-preserved and is generally perceived as an area of strength for individuals with DS.[84] Thus, individuals with DS can generally recall information presented to them visually better than information presented auditorily. For example when someone "taps out a series of different special locations on a board," individuals with DS can successfully recall the pattern.[85] When presented with a single visuospatial task, children with DS can perform on par with or even above their developmentally matched peers.[86] However, when presented with a dual task (two tasks involving visuospatial processing, or a visuospatial task combined with a task which requires verbal processing), children with DS perform significantly below their peers on both tasks. This suggests that children with DS have a dual deficit in working memory: the phonological loop (as previously discussed), and a central executive impairment, which inhibits successful dual task performance.[87] Thus,

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[83] Lanfranchi, Cornoldi, and Vianello, "Verbal and Visuospatial Working Memory," 458–61. See also Vicari, Carlesimo, and Caltagirone, "Short-Term Memory," 532–37.

[84] Glynis Laws, "Working Memory in Children and Adolescents with Down Syndrome: Evidence from a Colour Memory Experiment," *Journal of Child Psychology and Psychiatry* 43, no. 3 (2002): 353–64; Nacinovich et al., "Cognitive Development," 5; Jarrold and Baddeley, "Short-Term Memory," 18.

[85] This type of assessment is called a Corsi span task. Jarrold and Baddeley, "Short-Term Memory," 18.

[86] Lanfranchi et al., "Working Memory," 162–63; Hick, Botthing, and Conti-Ramsden, "Short-Term Memory," 536; Lanfranchi, Cornoldi, and Vianello, "Verbal and Visuospatial Working Memory," 461–64.

[87] Lanfranchi et al., "Working Memory in Down Syndrome: Is There a Dual Task Deficit?," *JIDR* 56, no. 2 (2012): 162–64. Vicari and colleagues also suggest a central executive impairment which affects short-term memory, evidenced by a severe deficit for children with DS to perform backward spans. Vicari, Carlesimo, and Caltagirone, "Short-Term Memory," 532–37. Roberts and

though the visuospatial component is a strength for individuals with DS, when faced with multiple simultaneous tasks, children with DS do not seem to benefit from this strength, possibly due to a deficit in central executive functioning. Additionally, when visuospatial information is presented simultaneously rather than sequentially, children with DS perform more poorly than peers, suggesting that "spatial-simultaneous (working memory) is a relatively weak area in the cognitive profile of individuals with DS."[88]

Similarly, though visuospatial short-term memory is a relative strength for individuals with DS, it seems that visuospatial working memory (i.e., when the information must be manipulated), is not as well preserved. For example, Vicari and colleagues found that individuals with DS performed on par with MA-matched TD participants and participants with intellectual disability on a Corsi span forward task, but below both groups in the Corsi span backward task.[89] Lanfranchi and colleagues found similar results. While participants with DS performed slightly above MA-matched peers on two visuospatial tasks which required low control (short-term memory), as the control required for the tasks increased (working memory) so too did the difference between controls and the DS group, with the DS group performing below controls.[90] Laws posits that the advantage for the visual-spatial memory in individuals with DS is spatial rather than visual. She found that while children with DS scored significantly higher on a Corsi

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Richmond found that this deficit in memory and executive function is not found in preschoolers, suggesting that it develops as children with DS age. Roberts and Richmond, "Preschoolers with Down Syndrome," 404–19.

[88] Silvia Lanfranchi, Irene C. Mammarella, and Barbara Carretti, "Spatial-Simultaneous Working Memory and Selective Interference in Down Syndrome," *Child Neuropsychology* 21, no. 4 (2015): 487. See also Barbara Carretti, Silvia Lanfranchi, and Irene C. Mammarella, "Spatial-Simultaneous and Spatial-Sequential Working Memory in Individuals with Down Syndrome: The Effect of Configuration," *RDD* 34, no. 1 (2013): 669–75; S. Lanfranchi, B. Carretti, G. Spanò, and C. Cornoldi, "A Specific Deficit in Visuospatial Simultaneous Working Memory in Down Syndrome," *JIDR* 53, no. 5 (May 2009): 474–83.

[89] Vicari, Carlesimo, and Caltagirone, "Short-Term Memory," 532–37.

[90] Lanfranchi, Cornoldi, and Vianello, "Verbal and Visuospatial Working Memory," 461–64.

span task than did their control group matched for receptive vocabulary scores, the children with DS did not possess an advantage for color memory. Laws argues that the lack of advantage in the color memory task was due to the absence of a spatial component in the task, suggesting a spatial rather than visual-spatial advantage for individuals with DS.[91]

The relationship between working memory and language development is somewhat ambiguous, though a growing body of evidence suggests that impairments in VSTM negatively affects language development in children with DS.[92] Deficits in VSTM reduce sentence comprehension, especially as length and grammatical complexity increase.[93] Phonological memory is a significant predictor of vocabulary acquisition, and to a lesser extent, grammar comprehension (especially in the younger years).[94]

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[91] Laws, "Working Memory in Children and Adolescents," 359–62.

[92] For evidence of no relationship between VSTM (as measured by digit span) and language development, see Christopher Jarrold and Alan D. Baddeley, "Short-Term Memory for Verbal and Visuospatial Information in Down's Syndrome," *Cognitive Neuropsychiatry* 2, no. 2 (1997): 112; Michael M. Marcell, Pamela S. Croen, and David H. Sewell, "Language Comprehension in Down Syndrome and Other Trainable Mentally Handicapped Individuals" (paper presented at the biennial Conference on Human Development, Richmond, VA, March 29–31, 1990). Laws also found no relationship between digit span measures and language development, though she did find evidence of a link between vocabulary and VSTM as measured by nonword repetition. Glynis Laws, "The Use of Nonword Repetition as a Test of Phonological Memory in Children with Down Syndrome," *Journal of Child Psychology and Psychiatry and Allied Disciplines* 39, no. 8 (1998): 1119–30. Mosse and Jarrold found that deficits in VSTM did not impair novel word-learning in children with DS. Emma K. Mosse and Christopher Jarrold, "Evidence for Preserved Novel Word Learning in Down Syndrome Suggests Multiple Routes to Vocabulary Acquisition," *Journal of Speech, Language and Hearing Research* 54, no. 4 (2011): 1137–52. Kari-Anne B. Næss and colleagues found no evidence of a longitudinal predictive relationship between VSTM and vocabulary development. Kari-Anne B. Næss et al., "Longitudinal Relationships between Language and Verbal Short-Term Memory Skills in Children with Down Syndrome," *Journal of Experimental Child Psychology* 135 (2015): 52.

[93] Miolo, Chapman, and Sindberg, "Sentence Comprehension," 185; Bernadette Witecy and Martina Penke, "Language Comprehension in Children, Adolescents, and Adults with Down Syndrome," *RDD* 62 (2017): 193.

[94] Glynis Laws and Deborah Gunn, "Phonological Memory as a Predictor of Language Comprehension in Down Syndrome: A Five-Year Follow-up Study," *Journal of Child Psychology and Psychiatry* 45, no. 2 (2004): 326–37; Steve Majerus and Koviljka Barisnikov, "Verbal Short-Term Memory Shows a Specific Association with Receptive but Not Productive Vocabulary Measures in Down Syndrome," *JIDR* 62, no. 1 (2018): 10–20; Jarrold, Baddeley, and Phillips, "Verbal Short-Term Memory,"

Phonological memory not only contributes to receptive language, but contributes significantly to expressive language skills as well.[95] Additionally, it seems the relationship between language and VSTM in individuals with DS is to some extent reciprocal. Vocabulary levels are a predictor of later phonological memory skills in children with DS with higher vocabulary levels, and language impairment in individuals with DS contributes to difficulties in some verbal-memory tasks.[96] Despite these difficulties, it is possible that in some tasks, such as word identification (reading), individuals with DS are able to draw upon their visuospatial skills to compensate for their deficit in verbal-memory skills.[97]

Long-term memory. Long-term memory is "the process of storing information that can be retrieved for use in minutes, hours, or years later."[98] Individuals with DS exhibit deficits in long-term memory throughout their lifespan, generally

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531–44; Robin S. Chapman, Linda J. Hesketh, and Doris J. Kistler, "Predicting Longitudinal Change in Language Production and Comprehension in Individuals with Down Syndrome: Hierarchical Linear Modeling," *JSLHR* 45, no. 5 (2002): 902–15; Robin S. Chapman and Linda J. Hesketh, "Language, Cognition, and Short-Term Memory in Individuals with Down Syndrome," *DSRP* 7, no. 1 (2001): 3–4.

[95] Glynis Laws, "Contributions of Phonological Memory, Language Comprehension and Hearing to the Expressive Language of Adolescents and Young Adults with Down Syndrome," *Journal of Child Psychology and Psychiatry* 45, no. 6 (2004): 1085–95; Glynis Laws and Dorothy V. M. Bishop, "A Comparison of Language Abilities in Adolescents with Down Syndrome and Children with Specific Language Impairment," *JSLHR* 46, no. 6 (2003): 1334; Robin and Hesketh, "Language, Cognition, and Short-Term Memory," 3–4; Rachel Fiona Hick, "Language and Memory Development in Children with Down Syndrome and Specific Language Impairment" (PhD diss., University of Manchester, 2003), 156–57; Yolanda D. Keller-Bell, "Linguistic Processing in Children with Down Syndrome" (PhD diss., Ohio State University, 2000), 80.

[96] "Higher vocabulary levels" refers to a vocabulary age over five years. Laws and Gunn, "Phonological Memory," 334; Jon Brock and Christopher Jarrold, "Language Influences on Verbal Short-Term Memory Performance in Down Syndrome: Item and Order Recognition," *Journal of Speech, Language and Hearing Research* 47, no. 6 (2004): 1334–46.

[97] Deborah J. Fidler, David E. Most, and Mark M. Guiberson, "Neuropsychological Correlates of Word Identification in Down Syndrome," *RDD* 26, no. 5 (2005): 487–501.

[98] Godfrey and Raitano Lee, "Memory Profiles," 5.

performing below TD peers matched on MA.[99] However, not all domains of long-term memory are equally impaired in individuals with DS. For example, Vicari and colleagues found that individuals with DS have a less preserved visual-object memory than visual-spatial memory.[100] Additionally, individuals with DS seem to have much better implicit long-term memory skills than explicit.[101] Most markedly, individuals with DS have deficits in verbal long-term memory, and consistently score below MA-matched TD peers and individuals with various intellectual disabilities.[102] Deficits in long-term memory may affect some aspects of language development, such that deficits in phonotactic knowledge contribute to reduced sentence comprehension.[103]

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[99] Godfrey and Raitano Lee, "Memory Profiles," 6; Pennington et al., "The Neuropsychology of Down Syndrome," 75–93.

[100] Stefano Vicari, Samantha Bellucci, and Giovanni Augusto Carlesimo, "Visual and Spatial Long-Term Memory: Differential Pattern of Impairments in Williams and Down Syndromes," *Developmental Medicine and Child Neurology* 47, no. 5 (2005): 305–11. Visual-object memory refers to an object's physical characteristics while visual-spatial memory refers to an object's "position or motion in space" (305).

[101] Vicari, "Motor Development and Neuropsychological Patterns," 360–61; Giovanni A. Carlesimo, Luigi Marotta, and Stefano Vicari, "Long-Term Memory in Mental Retardation: Evidence for a Specific Impairment in Subjects with Down's Syndrome," *Neuropsychologia* 35, no. 1 (1997): 71–79.

[102] For MA-matched peers see Pennington et al., "The Neuropsychology of Down Syndrome," 75–93; Carlesimo, Marotta, and Vicari, "Long-Term Memory in Mental Retardation," 71–79; Sharon Nichols et al., "Mechanisms of Verbal Memory Impairment in Four Neurodevelopmental Disorders," *Brain and Language* 88, no. 2 (2004): 180–89. For individuals with intellectual disabilities, see Carlesimo, Marotta, and Vicari, "Long-Term Memory in Mental Retardation," 71–79; F. Munir, Kim M. Cornish, and J. Wilding, "Nature of the Working Memory Deficit in Fragile-X Syndrome," *Brain and Cognition* 44, no. 3 (2000): 387–401; Sarah N. Mattson and Edward P. Riley, "Implicit and Explicit Memory Functioning in Children with Heavy Prenatal Alcohol Exposure," *Journal of the International Neuropsychological Society* 5, no. 5 (1999): 462–71. However, Jarrold and colleagues found that individuals with DS do not have marked deficits in verbal long-term memory, but rather visual long-term memory. Christopher Jarrold, Alan D. Baddeley, and Caroline Phillips, "Long-Term Memory for Verbal and Visual Information in Down Syndrome and Williams Syndrome: Performance on the Doors and People Test," *Cortex* 43, no. 2 (2007): 233–47.

[103] Miolo, Chapman, and Sindberg, "Sentence Comprehension," 185.

Social/Emotional Behavior and Development

Individuals with DS are generally thought to be sociable and happy, and have been described as "charming," "affectionate," "outgoing," and "cheerful."[104] From infancy and continuing into school-aged years, children with DS demonstrate signs of sociability and social competence.[105] Despite some qualitative differences in social and emotional development, children with DS seem to develop many of the same social skills as TD developing children, though sometimes to a lesser extent.[106] Social development is a relative strength for individuals with DS, and they may often use it to compensate for other weaknesses, especially when presented with tasks which are more cognitively challenging.[107] However, this tactic of resorting to social skills when presented with

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[104] Grieco et al., "Down Syndrome," 140; Deborah Fidler, David Most, and Amy Philofsky, "The Down Syndrome Behavioural Phenotype: Taking a Developmental Approach," *DSRP* (2008): 38; Elisabeth M. Dykens, "Psychiatric and Behavioral Disorders in Persons with Down Syndrome," *Mental Retardation and Developmental Disabilities Research Reviews* 13, no. 3 (2007): 276.

[105] Grieco et al., "Down Syndrome," 140; Fidler, Most, and Philofsky, "The Down Syndrome Behavioural Phenotype," 38; Infants with DS tend to exhibit a higher level of approach behaviors than TD infants. Candace F. Zickler, Judy D. Morrow, and Marilyn J. Bull, "Infants with Down Syndrome: A Look at Temperament," *Journal of Pediatric Health Care* 12, no. 3 (1998): 111–17. Gartsetein and colleagues found higher levels of cuddliness/affiliation in infants with DS relative to TD peers. Maria A. Gartstein, Julia Marmion, and Heather L. Swanson, "Infant Temperament: An Evaluation of Children with Down Syndrome," *Journal of Reproductive and Infant Psychology* 24, no. 1 (2006): 39. Though school-aged children with DS show some signs of asocial behaviors when compared with TD peers, they are able to form healthy friendships and relationships in the classroom, similar to TD children matched on MA. Michael J. Guralnick, Robert T. Connor, and L. Clark Johnson, "The Peer Social Networks of Young Children with Down Syndrome in Classroom Programmes," *Journal of Applied Research in Intellectual Disabilities* 24, no. 4 (2011): 319–20; Stephanny F. N. Freeman and Connie Kasari, "Characteristics and Qualities of the Play Dates of Children with Down Syndrome: Emerging or True Friendships?," *AJMR* 107, no. 1 (2002): 16–31.

[106] Grieco et al., "Down Syndrome," 140; Zickler, Morrow, and Bull, "Infants with Down Syndrome," 111–17; Koviljka Barisnikov and Fleur Lejeune found that children with DS have lesser developed social knowledge and social reasoning skills than their TD peers. Koviljka Barisnikov and Fleur Lejeune, "Social Knowledge and Social Reasoning Abilities in a Neurotypical Population and in Children with Down Syndrome," *PLoS ONE* 13, no. 7 (July 20, 2018): 12–13.

[107] Fidler, Most, and Philofsky, "The Down Syndrome Behavioural Phenotype," 38; Dykens, "Psychiatric and Behavioral Disorders," 276; Grieco et al., "Down Syndrome," 140; Deborah J. Fidler, and Lynn Nadel, "Education and Children with Down Syndrome: Neuroscience, Development, and Intervention," *Mental Retardation and Developmental Disabilities Research Reviews* 13, no. 3 (2007): 266–67; Deborah J. Fidler, "The Emerging Down Syndrome Behavioral Phenotype in Early Childhood:

difficult tasks may result in avoidance of completion of cognitively challenging tasks.[108]

Maladaptive behavior. Despite many positive characteristics, children with DS display a higher number of maladaptive social and emotional behaviors than do their TD peers.[109] Though individuals with DS display a larger number of psychiatric and behavioral issues than the normal population, the prevalence of such issues among the DS population seems to be lower than among other cognitively impaired populations.[110] Problematic behaviors, present in both boys and girls, can be manifested externally or internally. Externalized behaviors are most prominent in childhood, while internalizing problems seem to be more severe in adolescence and increase into adulthood.[111] External

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Implications for Practice," *Infants and Young Children* 18, no. 2 (2005): 90–91.

[108] Grieco et al., "Down Syndrome," 140; Fidler, Most, and Philofsky, "The Down Syndrome Behavioural Phenotype," 38; Connie Kasari and Stephanny F. N. Freeman, "Task-Related Social Behavior in Children with Down Syndrome," *AJMR* 106, no. 3 (2001): 261–63; T. K. Pitcairn and Jennifer G. Wishart, "Reactions of Young Children with Down's Syndrome to an Impossible Task," *British Journal of Developmental Psychology* 12, no. 4 (1994): 485–89.

[109] Lisa M. Jacola et al., "Behavior and Adaptive Functioning in Adolescents with Down Syndrome: Specifying Targets for Intervention," *Journal of Mental Health Research in Intellectual Disabilities* 7, no. 4 (2014): 297; Helma B. M. van Gameren-Oosterom et al., "Problem Behavior of Individuals with Down Syndrome in a Nationwide Cohort Assessed in Late Adolescence," *Journal of Pediatrics* 163, no. 5 (2013): 128–40; Helma B. M. van Gameren-Oosterom et al., "Development, Problem Behavior, and Quality of Life in a Population Based Sample of Eight-Year-Old Children with Down Syndrome," *PloS one* 6, no. 7 (2011): 6.

[110] Beverly A. Myers and Siegfried M. Pueschel, "Psychiatric Disorders in Persons with Down Syndrome," *Journal of Nervous and Mental Disease* 179, no. 10 (1991): 611–12; Dykens, "Psychiatric and Behavioral Disorders," 272; Elisabeth M. Dykens and Connie Kasari, "Maladaptive Behavior in Children with Prader-Willi Syndrome, Down Syndrome, and Nonspecific Mental Retardation," *AJMR* 102, no. 3 (1997): 234. For a comprehensive overview of neurobehavioral disorders in individuals with DS, see George Capone et al., "Neurobehavioral Disorders in Children, Adolescents, and Young Adults with Down Syndrome," *American Journal of Medical Genetics Part C: Seminars in Medical Genetics* 142, no. 3 (2006): 158–72.

[111] van Gameren-Oosterom et al., "Problem Behavior," 136; Dykens, "Psychiatric and Behavioral Disorders," 273–74; Grieco et al., "Down Syndrome," 140; Myers and Pueschel, "Psychiatric Disorders," 612–13; Dykens and Kasari, "Maladaptive Behavior," 234; Jeannie Visootsak and Stephanie Sherman, "Neuropsychiatric and Behavioral Aspects of Trisomy 21," *Current Psychiatry Reports* 9, no. 2 (2007): 135–40; E. M. Dykens et al., "Maladaptive Behaviour in Children and Adolescents with Down's Syndrome," *JIDR* 46, no. 6 (2002): 489.

behaviors for which children and adolescents with DS are at an increased risk include aggressive or rule-breaking behavior, social problems, attention problems, hyperactivity, and increased repetitive behavior.[112] Additionally, young children may especially be prone to hyperactivity, tantrums, impulsivity, stubbornness, and disobedience.[113] Internal behaviors for which individuals with DS are more at risk include somatic complaints, anxiety, depression, and withdrawal.[114] Adolescents tend to withdraw more, engage in secretive activity, and experience higher rates of anxiety and depression than children.[115] Maladaptive behaviors such as attention problems and social withdrawal have been found to negatively impact adaptive functioning in adolescents with DS.[116]

Adaptive functioning. Adaptive functioning (sometimes referred to as adaptive behavior) refers to an individual's ability to successfully function in his or her environment, and encompasses communication, social, and practical skills.[117] In relation to their TD peers, older children with DS lag further behind in adaptive functioning skills

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[112] Jacola et al., "Behavior and Adaptive Functioning," 298; van Gameren-Oosterom et al., "Development, Problem Behavior", 5–6; van Gameren-Oosterom et al., "Development, Problem Behavior", 5–6; Myers and Pueschel, "Psychiatric Disorders," 612–13; Dykens et al., "Maladaptive Behaviour," 488–89; Valérie Côté et al., "Behavioural Characteristics Related to Adaptive Functioning in Young Persons with Tuberous Sclerosis Complex, Down Syndrome and Fragile x Syndrome," *Journal of Developmental and Physical Disabilities* 33 (2021): 288.

[113] Matthew S. Siegel and Wendy E. Smith, "Psychiatric Features in Children with Genetic Syndromes: Toward Functional Phenotypes," *Child and Adolescent Psychiatric Clinics of North America* 19, no. 2 (2010): 236; Capone et al., "Neurobehavioral Disorders," 160; Grieco et al., "Down Syndrome," 140.

[114] Jacola et al., "Behavior and Adaptive Functioning," 298; van Gameren-Oosterom et al., "Development, Problem Behavior," 5–6; van Gameren-Oosterom et al., "Development, Problem Behavior," 5–6; Myers and Pueschel, "Psychiatric Disorders," 612–13; Dykens et al., "Maladaptive Behaviour," 488–89.

[115] Dykens et al., "Maladaptive Behaviour," 488–89.

[116] Jacola et al., "Behavior and Adaptive Functioning," 299–300.

[117] Anastasia Dressler et al., "Adaptive Behaviour in Down Syndrome: A Cross-Sectional Study from Childhood to Adulthood," *Wiener Klinische Wochenschrift* 122, no. 23 (2010): 674–75.

than do younger children, possibly due to the increasing environmental demands in early adolescence and adolescence.[118] However, individuals with DS continue to increase their adaptive functioning skills into adulthood, and even maintain them relative to cognitive plateau or decline.[119] Children with DS score highest on measures of daily living skills which rely heavily on implicit memory.[120] While most children with DS have relatively strong levels of social competence, others do not.[121] Expressive communication seems to be the weakest skill for children with DS, whereas receptive skills are a relative strength.[122]

Behavioral comorbidities. Children with DS are far more likely to receive a diagnosis of ASD than are the general population, though possibly less so than other people with intellectual disabilities.[123] Though prevalence rates in the DS population vary

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[118] Nacinovich et al., "Cognitive Development," 5. However, not all adolescents plateau or decline during these years. Elisabeth M. Dykens, Robert M. Hodapp, and David W. Evans, "Profiles and Development of Adaptive Behavior in Children with Down Syndrome," *DSRP* 9, no. 3 (2006): 48–49.

[119] Dressler et al., "Adaptive Behaviour," 679–80.

[120] Nacinovich et al., "Cognitive Development," 5; Dressler et al., "Adaptive Behaviour," 679; Dykens, Hodapp, and Evans, "Profiles and Development," 48.

[121] For high levels of social competence in children, see Nacinovich et al., "Cognitive Development," 5; Dykens, Hodapp, and Evans, "Profiles and Development," 48; Deborah Fidler, Susan Hepburn, and Sally Rogers, "Early Learning and Adaptive Behaviour in Toddlers with Down Syndrome: Evidence for an Emerging Behavioural Phenotype?," *DSRP* 9, no. 3 (2006): 42. For lower levels of social competence in children, see Dressler et al., "Adaptive Behaviour," 679.

[122] Dykens, Hodapp, and Evans, "Profiles and Development," 48; Fidler, Hepburn, Rogers, "Early Learning," 42. It should be noted that, at least in the Dykens' study, these expressive and receptive skills are not based off "measures of grammar, vocabulary, or other aspects of language that are characteristic of previous studies," but rather measures of adaptive communication. Dykens, Hodapp, and Evans, "Profiles and Development," 48.

[123] For prevalence rates of ASD in DS, see Judy Seesahai et al., "Prevalence of Autism Spectrum Disorder (ASD) in all Individuals Diagnosed with Down Syndrome (DS): A Systematic Review and Meta-Analysis Protocol," *Journal of Clinical and Medical Research* 4, no. 4 (2022): 1–20. For comparison to other intellectual disabilities, see C. A. Molloy et al., "Differences in the Clinical Presentation of Trisomy 21 with and without Autism," *JIDR* 53, no. 2 (2009): 144. However, see Peder Rasmussen et al., "Autistic Disorders in Down Syndrome: Background Factors and Clinical Correlates," *Developmental Medicine and Child Neurology* 43, no. 11 (2001): 750 and Jens Lund,

widely, Capone and colleagues suspect the actual prevalence of ASD in the DS population to be one in twenty, a twenty-five-fold increase over the general population at the time of publication (2005).[124] Many of the clinical symptoms of ASD, such as stereotypy, obsessional traits, and deficits in communication and social skills, are similar to those of DS, making a diagnosis for ASD in children with DS difficult.[125] Additionally, ASD seems to manifest itself somewhat differently in children with DS than children without DS.[126] As a result, children with DS are often not diagnosed with ASD until later in childhood or adolescence.[127] Children with a dual-diagnosis of DS and ASD tend to display more anxious behavior, social withdrawal, and stereotypy (especially odd or bizarre behavior) than their peers with DS without an ASD

"Psychiatric Aspects of Down's Syndrome," *Acta Psychiatrica Scandinavica* 78, no. 3 (1988): 369–74 for different results and interpretation. Collacott and colleagues found similar prevalence rates among adults with DS and intellectual disability from varying pathologies. R. A. Collacott, S. A. Cooper, and C. McGrother, "Differential Rates of Psychiatric Disorders in Adults with Down's Syndrome Compared with Other Mentally Handicapped Adults," *British Journal of Psychiatry: The Journal of Mental Science* 161, no. 5 (1992): 671–74.

[124] George T. Capone et al., "Down Syndrome and Comorbid Autism-Spectrum Disorder: Characterization Using the Aberrant Behavior Checklist," *American Journal of Medical Genetics Part A* 134, no. 4 (2005): 373. It is important to note that prevalence rates in both the general and ASD population may have increased since the time of Capone's estimation of prevalence. K. A. Kroeger and W. M. Nelson, "A Language Programme to Increase the Verbal Production of a Child Dually Diagnosed with Down Syndrome and Autism," *JIDR* 50, no. 2 (2006): 102; Seesahai et al., "Prevalence of Autism Spectrum Disorder," 3–5.

[125] Molloy et al., "Differences in the Clinical Presentation," 148; Lindsey Kent et al., "Comorbidity of Autistic Spectrum Disorders in Children with Down Syndrome," *Developmental Medicine and Child Neurology* 41, no. 3 (1999): 157; John C. Carter et al., "Autistic-Spectrum Disorders in Down Syndrome: Further Delineation and Distinction from Other Behavioral Abnormalities," *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics* 144, no. 1 (2007): 92; Capone et al., "Down Syndrome and Comorbid Autism-Spectrum Disorder," 375; Dykens, "Psychiatric and Behavioral Disorders," 273; Grieco et al., "Down Syndrome," 142.

[126] Carter et al., "Autistic-Spectrum Disorders," 92.

[127] Rasmussen and colleagues found that the mean age for an ASD diagnosis in individuals with DS was 14.4 years, compared to a mean of 6.9 years for those diagnosed without DS. Rasmussen et al., "Autistic Disorders," 751.

diagnosis.[128] Children with a dual-diagnosis also have lower cognition and poorer language and adaptive behavior skills than their peers with DS without ASD.[129] ASD in the DS population will be discussed in further detail in a subsequent section, as its prevalence and significance for language development warrants further consideration.

Another common dual-diagnosis which individuals with DS may receive which affects their behavior is attention-deficit/hyperactivity disorder (ADHD). Prevalence of ADHD among children with DS is generally reported as 6 to 8 percent.[130] However, a few studies have reported significantly higher rates, from 30 to 44 percent.[131] This discrepancy may be due in part to the fact that many children with DS display attention problems and hyperactivity, and the exact process of ADHD diagnosis in children with DS is not clear.[132]Additionally, children with DS are at an increased risk to be diagnosed with other behavioral disorders such as conduct or oppositional disorders.[133] These diagnoses differ from general behaviors of opposition or other maladaptive behaviors in children with DS in that they are more persistent, severe, and intense.[134]

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[128] Carter et al., "Autistic-Spectrum Disorders," 92.

[129] Molloy et al., "Differences in the Clinical Presentation," 148–49; Capone et al., "Down Syndrome and Comorbid Autism-Spectrum Disorder," 378.

[130] van Gameren-Oosterom et al., "Development, Problem Behavior," 1; Dykens, "Psychiatric and Behavioral Disorders," 273; Myers and Pueschel, "Psychiatric Disorders," 611; Lina Patel et al., "Behavioral Characteristics of Individuals with Down Syndrome," *Journal of Mental Health Research in Intellectual Disabilities* 11, no. 3 (2018): 223.

[131] Sivan Ekstein et al., "Down Syndrome and Attention-Deficit/Hyperactivity Disorder (ADHD)," *Journal of Child Neurology* 26, no. 10 (2011): 1292; Määttä et al., "Mental Health," 39; Jonathan M. Green, J. Dennis, and L. A. Bennets, "Attention Disorder in a Group of Young Down's Syndrome Children," *JIDR* 33, no. 2 (1989): 117.

[132] Ekstein et al., "Down Syndrome," 1292–93; Green, Dennis, and Bennets, "Attention Disorder," 120; Jacola et al., "Behavior and Adaptive Functioning," 300. For example, Määttä and colleagues reports that 33 percent of their participants "had behaviour suggestive of attention deficit hyperactivity disorder," though they were not officially diagnosed. Määttä et al., "Mental Health," 39, 41.

[133] Myers and Pueschel, "Psychiatric Disorders," 612–13; Dykens, "Psychiatric and Behavioral Disorders," 273.

[134] Capone et al., "Neurobehavioral Disorders," 161–62.

Despite the higher prevalence of such disorders, however, children and youth with DS are not very likely to engage in acts of extreme aggression.[135]

Language Development

Language is one of the "most impaired domains of functioning in individuals with DS."[136] While individuals with DS have a marked deficit in language development, not all facets of language are equally impaired.[137] The language profile of individuals with DS is characterized by receptive strengths and expressive weaknesses, especially expressive grammar, with additional, though less marked, weaknesses in phonology and pragmatics.[138] While the general pattern of language development in children with DS often follows that of TD children, Fabbretti and colleagues describe the language of children with DS as "qualitatively different" than that of TD children.[139] However, this qualitative difference is not clear, and further research is needed.[140] This section will examine the various facets of language development in individuals with DS, covering lexical, syntactic, morphological, and phonological development, as well as phonological awareness, pragmatics, and the interplay of language and cognition.

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[135] Dykens et al., "Maladaptive Behaviour," 489; Dykens, "Psychiatric and Behavioral Disorders," 273.

[136] Abbeduto, Warren, and Conners, "Language Development," 247.

[137] Næss et al., "Longitudinal Relationships," 43–55.

[138] For reviews of the language abilities of individuals with DS, see Martin et al., "Language Characteristics," 1–23; Abbeduto, Warren, and Conners, "Language Development," 247–61; Roberts, Price, and Malkin, "Language and Communication Development," 26–35; Robin S. Chapman and Elizabeth Kay-Raining Bird, "Language Development in Childhood, Adolescence, and Young Adulthood in Persons with Down Syndrome," in *The Oxford Handbook of Intellectual Disability and Development*, ed. Jacob A. Burack et al. (New York: Oxford University Press, 2011), 167–83.

[139] D. Fabbretti et al., "A Story Description Task in Children with Down's Syndrome: Lexical and Morphosyntactic Abilities," *JIDR* 41, no. 2 (1997): 177. See also Glynis Laws and Dorothy V. M. Bishop, "Verbal Deficits in Down's Syndrome and Specific Language Impairment: A Comparison," *IJLCD* 39, no. 4 (2004): 423–51, especially 426–27 for a discussion of delay versus deviance.

[140] Abbeduto, Warren, and Conners, "Language Development," 251–53, 257.

Lexical development. Lexical development refers to the acquisition and development of vocabulary.[141] Individuals with DS differ in their development of the two modalities of vocabulary, receptive and expressive. Receptive vocabulary tends to be a strength for individuals with DS, while expressive vocabulary lags behind that of receptive and is generally considered a weakness. In other words, individuals with DS can understand more words than they can speak.[142] Overall, the vocabulary of children with DS has been shown to be simpler than that of their TD peers.[143] As in other domains of development and language, the lexical abilities of individuals with DS varies widely.[144]

Receptive vocabulary development in children with DS follows the same basic pattern as that of TD children and is generally considered a strength for individuals with DS.[145] Individuals with DS often have receptive vocabulary skills on par with their

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[141] Bruce M. Rowe and Diane P. Levine, *A Concise Introduction to Linguistics* (Oxfordshire: Routledge, 2015) 4; Jack C. Richards and Richard W. Schmidt, *Longman Dictionary of Language Teaching and Applied Linguistics*, 4th ed. (London: Pearson, 2013), 339.

[142] See, for example, a novel word learning task, in which individuals with DS responded correctly to comprehension probes 28 percent of the time and to production probes only 6 percent of the time. Elizabeth Kay-Raining Bird et al., "Novel Word Acquisition in Children with Down Syndrome: Does Modality Make a Difference?," *JOCD* 33, no. 3 (2000): 258.

[143] Miguel Galeote et al., "The Acquisition of Different Classes of Words in Spanish Children with Down Syndrome," *JOCD* 75 (2018): 60, 65; Laura Zampini and Laura D'Odorico, "Lo sviluppo del vocabolario nei bambini con sindrome di Down: dati per età cronologica e di svilupp," *Psicologia clinica dello sviluppo* 16, no. 2 (2012): 331–46; Laura Zampini and Laura D'Odorico, "Lexical and Syntactic Development in Italian Children with Down's Syndrome," *IJLCD* 46, no. 4 (2011): 386–96; Arianna Bello, Daniela Onofrio, and Maria Cristina Casell, "Nouns and Predicates Comprehension and Production in Children with Down Syndrome," *RDD* 35, no. 4 (2014): 761–75. For differing results see Elena Checa, Miguel Galeote, and Pilar Soto, "The Composition of Early Vocabulary in Spanish Children with Down Syndrome and Their Peers with Typical Development," *AJSLP* 25, no. 4 (2016): 605–19.

[144] Laura Zampini and Laura D'Odorico, "Vocabulary Development in Children with Down Syndrome: Longitudinal and Cross-Sectional Data," *Journal of Intellectual and Developmental Disability* 38, no. 4 (2013): 313–14.

[145] Miguel Galeote et al., "The Development of Vocabulary in Spanish Children with Down Syndrome: Comprehension, Production, and Gestures," *Journal of Intellectual and Developmental Disability* 36, no. 3 (2011): 191; Laws et al., "Receptive Vocabulary and Semantic Knowledge," 502.

nonverbal cognition (NVC), and those skills can even surpass MA.[146] However, individuals in DS may have a dissociation between breadth and depth of vocabulary comprehension, such that while they can comprehend a large number of words, they have a "significant impairment in acquiring concept knowledge."[147] The growth of receptive vocabulary skills of individuals with DS can continue into young adulthood, after which time they may begin to decline.[148] Significant factors for receptive vocabulary in individuals with DS are NVC (often expressed as MA), CA and to a lesser degree, hearing status.[149]

While expressive vocabulary development in children with DS follows the same general pattern as that of TD children, children with DS lag behind their peers considerably in reaching milestones of development, with significant individual

[146] Chapman et al., "Language Skills: Production Deficits," 9. The authors note that the way in which MA is assessed will affect its relationship to receptive vocabulary skills. See also Abbeduto, Warren, and Conners, "Language Development," 250–51. Chapman and colleagues describe the adolescents in their study as having "advanced vocabulary comprehension." Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children," 1114. For clear evidence of receptive vocabulary skills surpassing MA, see Galeote et al., "The Development of Vocabulary," 191.

[147] Laws et al., "Receptive Vocabulary and Semantic Knowledge," 502.

[148] Monica Cuskelly, Jenny Povey, and Anne Jobling, "Trajectories of Development of Receptive Vocabulary in Individuals with Down Syndrome," *Journal of Policy and Practice in Intellectual Disabilities* 13, no. 2 (2016): 115. For evidence of no decline, and even continued growth after twenty years of age, see Carr, "Six Weeks to 45 Years," 417. An earlier study by Carr showed a slight, though not significant increase, in receptive vocabulary scores in individuals with DS from ages thirty to thirty-five years. Janet Carr, "Patterns of Ageing in 30–35-year-olds with Down's Syndrome," *Journal of Applied Research in Intellectual Disabilities* 16, no. 1 (2003): 33. For mixed, though somewhat outdated results, regarding receptive vocabulary growth in adults with DS, see Jean-Adolphe Rondal and Annick Comblain, "Language in Adults with Down Syndrome," *Down's Syndrome, Research and Practice* 4, no. 1 (1996): 8.

[149] Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children," 1114–15. Chapman and colleagues found that CA was a much stronger predictor of receptive vocabulary than MA, accounting for 64 percent of the variance, as opposed to 14 percent for MA. Kay-Raining Bird found MA to be a stronger predictor for vocabulary comprehension than CA. However, Kay-Raining Bird's investigation was of novel word learning, not current vocabulary level. Kay-Raining Bird, "Novel Word Acquisition," 254–55. See also Susan J. Loveall et al., "Receptive Vocabulary Analysis in Down Syndrome," *RDD* 55 (2016): 12.

variation.[150] When compared to MA-matched peers on measurements of expressive vocabulary, individuals with DS generally score significantly lower, and their progress is much slower.[151] Some research demonstrates that the deficiency in expressive vocabulary becomes especially salient in adolescence.[152] Predictors for expressive vocabulary in children with DS are home literacy environment, auditory memory, receptive vocabulary, phonological awareness, and oral motor skills.[153] Though receptive vocabulary and auditory memory also predict expressive vocabulary in TD children, they seem to be much more significant factors for children with DS.[154] As with receptive vocabulary, expressive vocabulary in children with DS is more closely related to MA rather than CA.[155]

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[150] Kari-Anne B. Næss, Johanne Ostad, and Egil Nygaard, "Differences and Similarities in Predictors of Expressive Vocabulary Development between Children with Down Syndrome and Young Typically Developing Children," *Brain Sciences* 11, no. 3 (2021): 2; Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 311; Danielle te Kaat-van den Os et al., "Expressive Vocabulary Development in Children with Down Syndrome: A Longitudinal Study," *Journal of Policy and Practice in Intellectual Disabilities* 14, no. 4 (2017): 316; Eva Berglund, Mårten Eriksson, and Iréne Johansson, "Parental Reports of Spoken Language Skills in Children with Down Syndrome," *JSLHR* 44, no. 1 (2001): 188.

[151] Næss, Ostad, and Nygaard, "Differences and Similarities," 10; Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 315–16; Chapman et al., "Language Skills: Production Deficits," 6; Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 772. Galeote and colleagues found that the trajectory of expressive development skills, both oral and gestural, for young children with DS followed that of TD children and found no significant differences in expressive vocabulary between the two groups. Galeote et al., "The Development of Vocabulary," 192–93.

[152] Andrea McDuffie, Robin S. Chapman, and Leonard Abbeduto, "Language Profiles of Adolescents and Young Adults with Down Syndrome and Fragile X Syndrome," in *Speech and Language Development and Intervention in Down Syndrome and Fragile X Syndrome*, ed. Joanne E. Roberts, Robin S. Chapman, and Steven F. Warren, Communication and Language Intervention (Baltimore: Paul H. Brookes, 2008), 117–42; Abbeduto, Warren, and Conners, "Language Development," 250. Chapman and colleagues found no evidence of a plateau in expressive language skills in adolescence. Chapman et al., "Language Skills: Production Deficits," 13. For differing results see Joanne Roberts et al., "Receptive Vocabulary, Expressive Vocabulary, and Speech Production," 188.

[153] Næss, Ostad, and Nygaard, "Differences and Similarities," 11–12.

[154] Næss, Ostad, and Nygaard, "Differences and Similarities," 12.

[155] Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 316; Kay-Raining Bird, "Novel Word Acquisition," 254–55; Zampini and D'Odorico, "Lo sviluppo del

The process of vocabulary acquisition and the ability of children with DS to learn novel words varies somewhat from that of TD children. However, the evidence is not unambiguous. While some studies demonstrate unimpaired novel word learning capabilities of children with DS, others reveal deficits.[156] Children with DS generally need more exposure than their MA matched peers to produce a new word. Kay-Raining Bird and colleagues found that fifteen exposures to a novel word was not always sufficient for young children with DS to produce the word when solicited.[157] However, older children and adolescents with DS were able to spontaneously produce novel words in the retelling of a story, after only three exposures to the word, at the same rate as MA-matched TD controls, though they did have more difficulty defining the word than the TD participants.[158]

While children with DS may perform on par with MA-matched TD peers on levels of static receptive vocabulary knowledge, it seems that they may not learn novel words in the receptive mode as quickly.[159] There is some evidence that signs or gestures

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vocabulario," 331–46.

[156] For studies demonstrating unimpaired novel word learning in individuals with DS, see Mosse and Jarrold, "Evidence for Preserved Novel Word Learning," 1137–52, and Robin S. Chapman, Elizabeth Kay-Raining Bird, and Scott E. Schwartz, "Fast Mapping of Words in Event Contexts by Children with Down Syndrome," *Journal of Speech and Hearing Disorders* 55, no. 4 (1990): 761–70. For studies demonstrating impaired novel word learning, see Kay-Raining Bird, "Novel Word Acquisition," 241–66. Jarrold, Thorn, and Stephens found unimpaired abilities to learn novel word referents and impaired abilities to learn novel word forms. Christopher Jarrold, Annabel S.C. Thorn, and Emma Stephens, "The Relationships among Verbal Short-Term Memory, Phonological Awareness, and New Word Learning: Evidence from Typical Development and Down Syndrome," *Journal of Experimental Child Psychology* 102, no. 2 (2009): 196–218.

[157] It is important to note that the MA-matched TD children also had low production, though higher than the participants with DS, which was virtually non-existent. Kay-Raining Bird, "Novel Word Acquisition," 257–58.

[158] Kay-Raining Bird, Chapman, and Schwartz, "Fast Mapping of Words and Story Recall," 1297.

[159] Kay-Raining Bird, "Novel Word Acquisition," 258–59. An early fast mapping study by Chapman and colleagues found that participants with DS performed just as well as the MA-matched TD control group and found no significant differences in production or comprehension. Chapman, Kay-Raining

may support spoken word comprehension and production in children with DS, but the data is not clear.[160] A principal factor in impaired word learning for individuals with DS seems to be deficits in VSTM, possibly mediated (constrained) by phonological awareness skills.[161] However, in multiple tasks, Mosse and Jarrold found that impaired VSTM was not a barrier to children with DS learning novel words.[162] They suggest that to compensate for impaired VSTM, individuals with DS draw upon "a domain-general process reflecting long-term memory for serial order" to learn new words.[163] More research is needed to clarify the novel word learning abilities of individuals with DS and the process of their vocabulary acquisition.

Grammatical development. Grammar is generally divided into two domains: syntactic and morphological. However, the two are often combined and referred to as morphosyntax, as reflected in the literature on language development in individuals with

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Bird, and Schwartz, "Fast Mapping of Words in Event Contexts," 761–70. However, the lack of differences may be due to the simplistic nature of the task. Elizabeth Kay-Raining Bird, Robin S. Chapman, and Scott E. Schwartz, "Fast Mapping of Words and Story Recall by Individuals with Down Syndrome," *JSLHR* 47, no. 6 (2004): 1288.

[160] Kay-Raining Bird, "Novel Word Acquisition," 259–61; Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 772; Danielle J.A. te Kaat-van den Os et al., "Do Gestures Pave the Way?: A Systematic Review of the Transitional Role of Gesture during the Acquisition of Early Lexical and Syntactic Milestones in Young Children with Down Syndrome," *Child Language Teaching and Therapy* 31, no. 1 (2015): 71–84. Dimitrova and colleagues found that parents' verbal translation of children's signed gestures facilitates expressive word learning in young children with DS, just as in TD children. Nevena Dimitrova, Şeyda Özçalışkan, and Lauren B. Adamson, "Parents' Translations of Child Gesture Facilitate Word Learning in Children with Autism, Down Syndrome and Typical Development," *JADD* 46, no. 1 (2016): 227–28.

[161] Christopher Jarrold, Annabel S. C. Thorn, and Emma Stephens, "The Relationships among Verbal Short-Term Memory, Phonological Awareness, and New Word Learning: Evidence from Typical Development and Down Syndrome," *Journal of Experimental Child Psychology* 102, no. 2 (2009): 211–12. Verbal (phonological) short-term memory may be especially important for word learning for young school-aged children. Susan E. Gathercole et al., "Phonological Memory and Vocabulary Development during the Early School Years: A Longitudinal Study," *Developmental Psychology* 28, no. 5 (1992): 887–98.

[162] Mosse and Jarrold, "Evidence for Preserved Novel Word Learning," 1142, 1145.

[163] Mosse and Jarrold, "Evidence for Preserved Novel Word Learning," 1143.

DS. Grammatical skills in individuals with DS are markedly impaired, so much so that Perovic refers to a "selective grammatical deficit" in individuals with DS.[164]

Syntax refers to the way in which phrases, clauses, and sentences are structured and can be thought of as grammar at the sentence level.[165] Though the order of development of syntactical skills seems comparable in TD children and children with DS, the rate of development for children with DS is slower.[166] Syntactical comprehension skills of individuals with DS lags behind that of their lexical skills, and this gap increases with age.[167] Syntactic comprehension skills of individuals with DS are sometimes found to be lower than their MA, though results depend on how syntactic comprehension is measured.[168] Moreover, the grammar skills of children with DS seems to be lower even than that of children with other intellectual disabilities.[169] Complex syntax is especially

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[164] Alexandra Perovic, "Syntactic Deficit in Down Syndrome: More Evidence for the Modular Organisation of Language," *Lingua* 116, no. 10 (2006): 1627. This claim is bolstered by research by Yoder and colleagues which demonstrates that the ability for individuals to properly process speech sound is "strongly associated with the degree of impairment in morphological comprehension." Paul J. Yoder et al., "Association between Differentiated Processing of Syllables and Comprehension of Grammatical Morphology in Children with Down Syndrome," *AJMR* 111, no. 2 (2006): 146. In other words, impairment in grammatical comprehension may hinder individuals with DS from effectively processing spoken speech. Research also suggests that morphosyntactic skills may affect the acquisition of verbs in individuals with DS. Galeote et al., "The Acquisition of Different Classes of Words," 69.

[165] Andrew Carnie, *Syntax: A Generative Introduction*, 3rd ed. (Oxford: Wiley-Blackwell, 2012), 4; Rowe and Levin, *A Concise Introduction*, 111.

[166] Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 187, 189; Miguel Galeote et al., "Early Grammatical Development in Spanish Children with Down Syndrome," *Journal of Child Language* 41, no. 1 (2014): 127; Fabbretti et al., "A Story Description Task," 176–77.

[167] Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children," 1115; Chapman et al., "Language Skills: Production Deficits," 9; Witecy and Penke, "Language Comprehension," 192; Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 186, 189.

[168] Chapman et al., "Language Skills: Production Deficits," 9; Laura Zampini et al., "Prosodic Skills in Children with Down Syndrome and in Typically Developing Children," *IJLCD* 51, no. 1 (2016): 80. Chapman and colleagues found that syntactic comprehension skills were on par with MA. Chapman et al., "Language Skills: Production Deficits," 9.

[169] M. Koizumi, Y. Saito, and M. Kojima, "Syntactic Development in Children with Intellectual Disabilities–Using Structured Assessment of Syntax," *JIDR* 63, no. 12 (2019): 1438. Chapman

difficult for individuals with DS to understand, so that as complexity of sentences increases, comprehension decreases.[170]

Expressive syntax seems to be one of the weakest language skills in individuals with DS and rather consistently measures below MA.[171] However, expressive syntax continues to grow well into adolescence and even into young adulthood, whereas it seems that receptive syntax may begin to slow down or decline earlier.[172] Not all expressive syntactic skills of individuals with DS are equally impaired. Individuals in DS seem to produce longer utterances when telling a story as opposed to engaging in conversation.[173] Despite longer and more frequent utterances in storytelling, individuals with DS tend to omit grammatical morphemes and words, especially verbs and function

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also found that children and adolescents with DS scored lower on measures of syntactic comprehension than did children of cognitive impairment of unknown origin matched for cognitive skills. Chapman, “Language Learning in Down Syndrome,” 63.

170 Witecy and Penke, “Language Comprehension,” 192.

171 See, for example, Chapman et al., “Language Skills: Production Deficits,” 6, 9; Sarah E. Michael, Nan Bernstein Ratner, and Rochelle Newman, “Verb Comprehension and Use in Children and Adults with Down Syndrome,” *Journal of Speech, Language and Hearing Research* 55, no. 6 (2012): 1744.

172 Abbeduto, Warren, and Conners, “Language Development,” 252. For growth in expressive syntax, see Elin T. Thordardottir, Robin S. Chapman, and Laura Wagner, “Complex Sentence Production by Adolescents with Down Syndrome,” *Applied Psycholinguistics* 23, no. 2 (2002): 163–83; Chapman et al., “Predicting Language Production,” 340–50; Chapman, Hesketh, and Kistler, “Predicting Longitudinal Change;” 902–15; Chapman et al., “Language Skills: Production Deficits,” 1–21. For decline in receptive syntax, see McDuffie, Chapman, and Abbeduto, “Language Profiles of Adolescents and Young Adults,” 117–42; Chapman, Hesketh, and Kistler, “Predicting Longitudinal Change;” 902–15; Laws and Gunn, “Phonological Memory,” 326–37. However, Witecy and Penke found that individuals with DS continued to grow in receptive syntactic abilities throughout adolescence (up to nineteen years old), and plateau in adulthood (twenties and thirties). Witecy and Penke, “Language Comprehension,” 184–96.

173 Chapman et al., “Language Skills: Production Deficits,” 9. This is especially true if children can preview the story beforehand and/or have visual supports. Chapman, “Language Learning in Down Syndrome,” 63; Miles, Chapman, and Sindberg, “Sampling Context Affects MLU,” 325–37. See also Roberts, Price, and Malkin, “Language and Communication Development,” 30; Martin et al., “Language Characteristics,” 7. However, van Bysterveldt and Westerveld found that “significant delays in grammatical ability” despite support from photographs. Anne K. van Bysterveldt and Marleen F, Westerveld, “Children with Down Syndrome Sharing Past Personal Event Narratives with their Teacher Aides: A Pilot Study,” *International Journal of Disability, Development and Education* 64, no. 3 (2017): 259.

words.[174] Overall, individuals with DS produce more single word utterances and fewer multi-word utterances than TD MA-matched peers, and produce very few complex sentences.[175] Predictors of syntactic comprehension are CA, MA, and to a much lesser degree, hearing status.[176] Additionally, working memory (as measured by auditory short-term memory and visual short-term memory) has been found to be a significant factor for syntactic comprehension, with phonological memory playing an especially important role for young children.[177] Comprehension seems to be a main factor in expressive syntax, while CA and auditory and visual short-term memory may also play a role.[178]

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[174] Chapman et al., "Language Skills: Production Deficits," 7–9; Fabbretti et al., "A Story Description Task," 165–79; Michael, Bernstein Ratner, and Newman, "Verb Comprehension and Use," 1745; Miles, Chapman, and Sindberg, "Sampling Context Affects MLU," 332; Linda J. Hesketh and Robin S. Chapman, "Verb Use by Individuals with Down Syndrome," *AJMR* 103, no. 3 (1998): 288–304.

[175] Zampini and D'Odorico, "Lexical and Syntactic Development," 386–96; Fabbretti et al., "A Story Description Task," 175, 177; Vicari, Caselli, and Tonucci, "Asynchrony of Lexical and Morphosyntactic Development," 641. In young children with DS, Galeote and colleagues found that even though the children with DS were able to produce sentences of similar length than TD controls matched for vocabulary levels, their sentences were less complex. Galeote et al., "Early Grammatical Development in Spanish Children," 125.

[176] Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children,"1114–15; Witecy and Penke, "Language Comprehension," 191–92; Chapman and colleagues did not find hearing status to be a predictor for syntax. Chapman et al., "Language Skills: Production Deficits," 8. Chapman, Hesketh, and Kistler found that NVC did not affect syntactic comprehension or production. Chapman, Hesketh, and Kistler, "Predicting Longitudinal Change," 912. See Chapman, "Language Learning in Down Syndrome," 64, for more similar results to Chapman, Hesketh, and Kistler.

[177] Chapman, Hesketh, and Kistler, "Predicting Longitudinal Change," 910; Witecy and Penke, "Language Comprehension," 193. For young children see Laws and Gunn, "Phonological Memory," 334.

[178] Chapman, Hesketh, and Kistler, "Predicting Longitudinal Change," 908–10; van Bysterveldt and Westerveld, "Sharing Past Personal Event Narratives," 258. Chapman and colleagues suggest that CA and cognition are mediated through comprehension for expressive syntax. Chapman et al., "Predicting Language Production," 347. Michael and colleagues found that measurements of sentence memory, though not general working memory, played a role in measurements of syntactic production. Michael, Bernstein Ratner, and Newman, "Verb Comprehension and Use," 1746. Chapman found that hearing status is correlated with syntax production (MLU), but only in the interview context, while phonological working memory is correlated with syntax production in both the interview and narrative modes. Chapman, "Language Learning in Down Syndrome," 64.

Morphology refers to the formation and internal structure of words and can be thought of as grammar (rules) at the word level.[179] Like syntactic abilities, morphological skills of individuals with DS lag behind their lexical skills and are generally considered a weakness.[180] Abbeduto and colleagues note that "grammatical morphology has often been found to be especially problematic for adolescents and young adults with DS" and seems to be even weaker than syntactical abilities, even in young children.[181] Chapman found that children and adolescents with DS scored significantly below children with cognitive impairment of unknown origin matched for cognitive abilities on measurements of grammatical morpheme comprehension.[182]

Individuals (children and adults) with DS tend to understand plural morphemes better than past tense morphemes.[183] When matched with TD children on measurements of mean length of utterance, children with DS produced fewer tense-related and non-tense related morphemes, especially regular past tense morphemes (-*ed*), and third person

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[179] Mark Aronoff and Kirsten Fudeman, *What Is Morphology?* (Oxford: Wiley-Blackwell, 2011), 2; Rowe and Levin, *A Concise Introduction*, 85; Andrea D. Sims and Martin Haspelmath, *Understanding Morphology* (London: Hodder Education, 2010), 1.

[180] Stefano Vicari, Maria Cristina Caselli, and Francesca Tonucci, "Asynchrony of Lexical and Morphosyntactic Development in Children with Down Syndrome," *Neuropsychologia* 38, no. 5 (2000): 634–44; Chapman et al., "Language Skills: Production Deficits," 11; Fabbretti et al., "A Story Description Task," 165–79; Perovic, "Syntactic Deficit in Down Syndrome," 1616–30; Checa, Galeote, and Soto, "The Composition of Early Vocabulary," 615.

[181] Abbeduto, Warren, and Conners, "Language Development," 252. For evidence of enhanced morphological impairment in adolescents and adults with DS, see Chapman et al., "Language Skills: Production Deficits," 11; Miolo, Chapman, and Sindberg, "Sentence Comprehension," 181. For evidence of a morphological deficit in young children which exceeds that of syntax, see Fabbretti et al., "A Story Description Task," 178. Eadie and colleagues found that expressive grammatical morphology of children with DS was significantly impaired when compared to TD children matched on the expressive syntactic measurement of mean length of utterance. Eadie et al., "Profiles of Grammatical Morphology," 720–32.

[182] Chapman, "Language Learning in Down Syndrome," 63.

[183] Witecy and Penke found this to be true for adults, while Joffe and Varlokosta found similar results for children ages five to fourteen. Witecy and Penke, "Language Comprehension," 192; Victoria Joffe and Spyridoula Varlokosta, "Language Abilities in Williams Syndrome: Exploring Comprehension, Production and Repetition Skills," *Advances in Speech Language Pathology* 9, no. 3 (2007): 221.

singular morphemes (-*s*), confirming that despite the amount of words they produce, their language is grammatically weaker.[184] However, individuals with DS seem fairly adept at producing irregular past tense and third person singular forms.[185] Finally, it seems that children with DS are not as easily able to acquire novel morphemes as TD peers matched either for language ability or MA, suggesting that children with DS have difficulty "learning and generalizing implicit grammatical rules."[186] Grammatical morpheme comprehension is correlated to hearing status, likely due to the need to distinguish similar high frequency sounds for proper comprehension.[187]

Phonological development. Phonology refers to the sounds in a language and how those sounds combine into larger units and can be thought of as the grammar of sound patterns of a language.[188] Children with DS have a marked speech production deficit which causes their speech to often be difficult to understand.[189] This deficit is not merely the result of lower cognition, but rather a disorder of phonological acquisition

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[184] Patricia A. Eadie et al., "Profiles of Grammatical Morphology and Sentence Imitation in Children with Specific Language Impairment and Down Syndrome," *JSLHR* 45, no. 4 (2002): 720–32. See also Chapman et al., "Language Skills: Production Deficits," 11, and Laws and Bishop, "A Comparison of Language Abilities," 1335, for similar results. However, Laws and Bishop found that individuals with DS with a mean length of utterance (MLU) of 4.5 or more did not differ significantly from controls matched on MLU and MA on the number of correctly produced regular and irregular past tense forms. Laws and Bishop, "A Comparison of Language Abilities," 1335–36.

[185] Laws and Bishop, "A Comparison of Language Abilities," 1335; Eadie et al., "Profiles of Grammatical Morphology," 727–28. However, Joffe and Varlokosta found that participants with DS performed equally poorly on regular and irregular verbs in an elicitation task. Joffe and Varlokosta, "Language Abilities in Williams Syndrome," 219.

[186] Keller-Bell, "Linguistic Processing," 96.

[187] Miolo, Chapman, and Sindberg, "Sentence Comprehension," 185; Chapman, "Language Learning in Down Syndrome," 64.

[188] Rowe and Levin, *A Concise Introduction*, 61; Bruce Hayes, *Introductory Phonology* (Oxford: Wiley-Blackwell, 2009), 19.

[189] K. Burgoyne, S. Buckley, and R. Baxter, "Speech Production Accuracy in Children with Down Syndrome: Relationships with Hearing, Language, and Reading Ability and Change in Speech Production Accuracy over Time," *JIDR* 65 no. 12 (2021): 1021–22.

unique to the DS population.[190] While there has been an ongoing debate as to whether the deficit is a disorder or a delay, Dodd and Thompson found that all participants with DS in their study exhibited inconsistent errors in speech, indicative of a disorder rather than delay.[191] Individuals with DS experience phonological difficulties in both perceiving and producing speech sounds resulting in impairments in fluency and intelligibility.[192] For example, Fabbretti and colleagues found that young children with DS misarticulated certain words more often than their TD controls matched on mean length of utterance in a story description task.[193]

Additionally, the systematic phonological errors (phonological processes) made by individuals with DS seem to persist for longer periods than in TD developing children.[194] Based upon single-word responses, Roberts and colleagues found that boys with DS performed below MA-matched TD boys and boys with Fragile X syndrome on measurements of articulation, sound accuracy, and phonological processes, demonstrating both greater delays and developmental differences compared to the other

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[190] Chapman et al., "Predicting Language Production," 347; Perovic, "Syntactic Deficit in Down Syndrome," 1619; Barbara Dodd and Laura Thompson, "Speech Disorder in Children with Down's Syndrome," *JIDR* 45, no. 4 (2001): 314.

[191] Dodd and Thompson, "Speech Disorder," 314. For initial arguments of a delay, see J.A. Rondal, "Down's Syndrome," in *Language Development in Exceptional Circumstances*, ed. Dorothy Bishop and Kay Mogford (Hove, UK: Psychology Press, 1993), 165–76. For initial arguments of a possible disorder, see Carol Stoel-Gammon, "Speech Development of Infants and Children with Down Syndrome," in *Speech Evaluation in Medicine*, ed. John K. Darby (New York: Grune and Stratton, 1981), 341–60. See also research conducted by Roberts and colleagues for evidence of "developmental differences," not simply delay. Joanne Roberts et al., "A Comparison of Phonological Skills of Boys with Fragile X Syndrome and Down Syndrome," *Journal of Speech and Language Hearing Research* 48, no.5 (2005): 980–95.

[192] For a helpful and thorough review, see Ray D. Kent and Houri K. Vorperian, "Speech Impairment in Down Syndrome: A Review," *Journal of Speech and Language Hearing Research* 56 no. 1 (2013): 1–43. See also Stoel-Gammon, "Down Syndrome Phonology," 93–100.

[193] Fabbretti et al., "A Story Description Task," 178, Though not a story description task, in their assessments of speech, Burgoyne and colleagues found participants articulated less "than 10% of consonant sounds accurately." Burgoyne, Buckley, and Baxter, "Speech Production Accuracy," 1021–32.

[194] Martin et al., "Language Characteristics," 4.

two groups.[195] Barnes and colleagues used connected speech samples and found that boys with DS showed greater delays on measurements of consonant production accuracy, proportion of whole word proximity, and phonological processes when compared to MA-matched boys with Fragile X syndrome with and without autism and TD boys.[196] Receptive vocabulary, phoneme blending, word reading, hearing status, and age are significant factors in speech production accuracy for individuals with DS.[197]

Difficulties in phonological development is only one of many factors which contribute to unintelligible speech in individuals with DS. Other factors which affect speech intelligibility include hearing status, age, speech-motor skills, verbal apraxia (motor planning disorders), and prosody.[198] Boys with DS were found to have significantly reduced intelligibility when compared to MA-matched TD boys using connected speech samples.[199] Intelligibility (as measured by the proportion of complete and intelligible utterances over total utterances) in individuals with DS seems to be particularly impaired when telling a story, as opposed to when engaged in conversation.[200] In their personal narrative task, van Bysterveldt and Westerveld found

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[195] Roberts et al., "A Comparison of Phonological Skills," 980–95.

[196] Elizabeth Barnes et al., "Phonological Accuracy and Intelligibility in Connected Speech of Boys with Fragile X Syndrome or Down Syndrome," *JSLHR* 52, no. 4 (2009): 1048–61.

[197] Burgoyne, Buckley, and Baxter, "Speech Production Accuracy," 1021–32; Laws and Hall, "Early Hearing Loss," 340; Stoel-Gammon, "Down Syndrome Phonology," 93–100.

[198] Chapman et al., "Predicting Language Production," 347; van Bysterveldt and Westerveld, "Sharing Past Personal Event Narratives," 260–61; Kent and Vorperian, "Speech Impairment in Down Syndrome," 1–43; Libby Kumin, "Speech Intelligibility and Childhood Verbal Apraxia in Children with Down Syndrome," *DSRP*, 10, no. 1 (2006): 10–22.

[199] Barnes et al., "Phonological Accuracy and Intelligibility," 1055–56. They did not, however, differ from MA-matched boys with Fragile X syndrome, with or without autism. Intelligibility was measured by percentage of intelligible words.

[200] Chapman et al., "Language Skills: Production Deficits," 9. The authors suggest that "availability of referential context in conversation benefits transcription of Down syndrome speech disproportionately" (9).

intelligibility rates from 69 to 98 percent, even after intelligibility related eligibility criteria.[201]

Phonological awareness is the conscious focus on the or awareness of the sound structure of a language.[202] Individuals with DS have a clear deficit in phonological awareness, though the root of this deficit is not clear.[203] Phonological awareness tasks such as syllable segmentation, syllable deletion, phoneme awareness and identification, and particularly rhyming, are impaired in individuals with DS.[204] Moreso, phonological awareness and decoding skills seem to lag behind word recognition skills.[205] Reduced phonological awareness seems to play a role in difficulties for individuals with DS to learn new word forms as well expressive vocabulary deficits.[206] Additionally,

[201] van Bysterveldt and Westerveld, "Sharing Past Personal Event Narratives," 260. See Miles, Chapman, and Sindberg for much higher rates of intelligibility. Sally Miles, Robin Chapman, and Heidi Sindberg, "Sampling Context Affects MLU in the Language of Adolescents with Down Syndrome," *JSLHR* 49, no. 2 (2006): 331.

[202] Linda Cupples and Teresa Iacono, "Phonological Awareness and Oral Reading Skill in Children with Down Syndrome," *JSLHR* 43, no. 3 (2000): 595; Abbeduto, Warren, and Conners, "Language Development," 256.

[203] Jarrold, Thorn, and Stephens, "Relationships among Verbal Short-Term Memory," 211–12; Dodd and Thompson, "Speech Disorder," 308.

[204] Brock and Jarrold, "Language Influences on Verbal Short-Term Memory," 1341–42; L. Verucci, D. Menghini, and S. Vicari, "Reading Skills and Phonological Awareness Acquisition in Down Syndrome," *JIDR* 50, no. 7 (2006): 477–91; Margaret J. Snowling, Charles Hulme, and Robin C. Mercer, "A Deficit in Rime Awareness in Children with Down Syndrome," *Reading and Writing* 15, no. 5 (2002): 471–95; Cláudia Cardoso-Martins, Mirelle França Michalick, and Tatiana Cury Pollo, "Is Sensitivity to Rhyme a Developmental Precursor to Sensitivity to Phoneme?: Evidence from Individuals with Down Syndrome," *Reading and Writing* 15, no. 5 (2002): 439–54; Cupples and Iacono, "Phonological Awareness and Oral Reading Skill," 603.

[205] Elizabeth Kay-Raining Bird, Patricia L. Cleave, and Lyndsey McConnell, "Reading and Phonological Awareness in Children with Down Syndrome: A Longitudinal Study," *AJSLP* 9, no. 4 (2000): 319–30.

[206] However, it does not seem to affect their ability to learn new word referents. Jarrold, Thorn, and Stephens, "Relationships among Verbal Short-Term Memory," 211. For differing results see Mosse and Jarrold, "Evidence for Preserved Novel Word Learning," 1148. For the relationship between phonological awareness and expressive vocabulary, see Næss, Ostad, and Nygaard, "Differences and Similarities," 1–19, and Glynis Laws and Deborah Gunn, "Relationships between Reading, Phonological Skills and Language Development in Individuals with Down Syndrome: A Five Year Follow-Up

phonological awareness significantly impacts reading abilities for children with DS, particularly reading speed and accuracy.[207] Despite the marked weakness in phonological awareness in individuals with DS, they can improve their phonological awareness skills to varying degrees through targeted interventions.[208]

Pragmatics. Pragmatics refers to the effect of context (such as social or affective) and situations on the meaning of language.[209] Pragmatic development is the ability to understand and use language in social contexts and includes skills such as requesting, initiating and taking turns in conversation, signaling noncomprehension, narrating events, nonverbal communication, and modifying speech to the needs of the listener or situation.[210] When compared to other domains of language in individuals with

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Study," *Reading and Writing* 15, no. 5 (2002): 541–43.

[207] Verucci, Menghini, and Vicari, "Reading Skills and Phonological Awareness," 482–83; Snowling, Hulmne, and Mercer, "A Deficit in Rime Awareness," 471–95; Cupples and Iacono, "Phonological Awareness and Oral Reading Skill," 595–608; Laws and Gunn, "Relationships between Reading," 541–43.

[208] Pamela Baylis and Margaret J. Snowling, "Evaluation of a Phonological Reading Programme for Children with Down Syndrome," *Child Language Teaching and Therapy* 28, no. 1 (2012): 39–56; Patricia L. Cleave, Elizabeth Kay-Raining Bird, and Derrick C. Bourassa, "Developing Phonological Awareness Skills in Children with Down Syndrome," *Canadian Journal of Speech-Language Pathology & Audiology* 35, no. 4 (2011): 332–43; Anne Katherine van Bysterveldt, Gail Gillon, and Susan Foster-Cohen, "Integrated Speech and Phonological Awareness Intervention for Pre-School Children with Down Syndrome," *International Journal of Language and Communication Disorders* 45, no. 3 (2010): 320–35; Kristina Goetz et al., "Training Reading and Phoneme Awareness Skills in Children with Down Syndrome," *Reading and Writing* 21, no. 4 (2008): 395–412; Anne K. van Bysterveldt, Gail T. Gillon, and Catherine Moran, "Enhancing Phonological Awareness and Letter Knowledge in Preschool Children with Down Syndrome," *International Journal of Disability, Development and Education* 53, no. 3 (2006): 301–29; Esther J. Kennedy and Mark C. Flynn, "Training Phonological Awareness Skills in Children with Down Syndrome," *RDD* 24, no. 1 (2003): 44–57.

[209] Rowe and Levin, *A Concise Introduction*, 170; Richards and Schmidt, *Longman Dictionary*, 449.

[210] Roberts, Price, and Malkin, "Language and Communication Development," 30; Abbeduto, Warren, and Conners, "Language Development," 253; Gary E. Martin et al., "A Multimethod Analysis of Pragmatic Skills in Children and Adolescents with Fragile X Syndrome, Autism Spectrum Disorder, and Down Syndrome," *JSLHR* 61, no. 12 (2018): 3023.

DS, pragmatics is a relative strength, though not in all aspects.[211] Vicari and colleagues note that children with DS have "good overall communicative abilities" despite "the deficiencies in their linguistic code."[212] While some aspects of pragmatics in individuals with DS seem on par with MA-matched peers, other aspects are considerably impaired.[213]

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[211] Roberts, Price, and Malkin, "Language and Communication Development," 30; Martin et al., "Language Characteristics," 6; Abbeduto, Warren, and Conners, "Language Development," 253. For example, Miles and Chapman found that pragmatic skills exceed expressive language skills and align more closely to measurements of receptive language and cognition. Sally Miles and Robin S. Chapman, "Narrative Content as Described by Individuals with Down Syndrome and Typically Developing Children," *JSLHR* 45, no. 1 (2002): 186. Similar results were found by Boudreau and Champan. Donna M. Boudreau and Robin S. Chapman, "The Relationship between Event Representation and Linguistic Skill in Narratives of Children and Adolescents with Down Syndrome," *JSLHR* 43, no. 5 (2000): 1154. Smith and colleagues found that pragmatic skills far exceeded the combined linguistic skills measured by the Children's Communication Checklist-2. Elizabeth Smith, Kari-Anne B. Næss, and Christopher Jarrold, "Assessing Pragmatic Communication in Children with Down Syndrome," *JOCD* 68 (2017): 19.

[212] Vicari, Caselli, and Tonucci, "Asynchrony of Lexical and Morphosyntactic Development," 641. Some research suggests that individuals with DS can compensate for grammatical and expressive deficiencies through the use of circumlocution and a greater number of simpler utterances. Abbeduto, Warren, and Conners, "Language Development," 253.

[213] For studies demonstrating pragmatic performance on par with MA peers, see Robert E. Owens and James D. MacDonald, "Communicative Uses of the Early Speech of Nondelayed and Down Syndrome Children," *American Journal of Mental Deficiency* 86, no. 5 (1982): 503–10; Truman E. Coggins, Robert L. Carpenter, and Nathaniel O. Owings, "Examining Early Intentional Communication in Down's Syndrome and Nonretarded Children," *IJLCD* 18, no. 2 (1983): 98–106. Franco and Wishart matched children on expressive language capabilities and found similar usage of gestures between the two groups. Fabia Franco and Jennifer G. Wishart, "Use of Pointing and Other Gestures by Young Children with Down Syndrome," *American Journal of Mental Retardation* 100, no. 2 (1995): 174–75. For studies demonstrating pragmatic performance below MA-matched peers, see Michelle Lee et al., "A Multi-Method Investigation of Pragmatic Development in Individuals with Down Syndrome," *American Journal on Intellectual and Developmental Disabilities* 122, no. 4 (2017): 289–309; Smith, Næss, and Jarrold, "Assessing Pragmatic Communication," 10–23; Leonard Abbeduto et al., "Signaling Noncomprehension of Language: A Comparison of Fragile X Syndrome and Down Syndrome," *AJMR* 113, no. 3 (2008): 214–30; Leonard Abbeduto et al., "Collaboration in Referential Communication: Comparison of Youth with Down Syndrome or Fragile X Syndrome," *AJMR* 111, no. 3 (2006): 170–83. Laws and Bishop found that while their participants with DS scored below the level of controls, they generally did not score so low as to indicate pragmatic impairment. Glynis Laws and Dorothy V. M. Bishop, "Pragmatic Language Impairment and Social Deficits in Williams Syndrome: A Comparison with Down's Syndrome and Specific Language Impairment," *IJLCD* 39, no. 1 (2004): 59. Among many other factors, one factor in determining whether or not individuals with DS measure at or below TD peers on a particular pragmatic skill may be age at the time of testing. Smith, Næss, and Jarrold, "Assessing Pragmatic Communication," 19.

Though the pattern of development may be similar to that of TD children, the evidence is not clear.[214]

In one study which compared the pragmatic skills of children and adolescents with various neurodevelopmental disabilities to a control group of TD children, participants with DS showed no deficits on measurements of key pragmatic skills.[215] Yet contrary to other studies in which pragmatic skills were found to exceed those of grammar in individuals with DS, Berglund and colleagues found that the lag of pragmatic skills in participants with DS in comparison to a TD group was larger than that of grammatical skills.[216] Individuals with DS seem to perform best on pragmatic tasks of nonverbal communication, social communication, and event retelling.[217] Conversely,

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[214] Abbeduto, Warren, and Conners, "Language Development," 250; Roberts, Price, and Malkin, "Language and Communication Development," 30. Berglund and colleagues found that the order of development of pragmatic skills in children with DS was "strikingly similar" to that of TD peers, though lagging behind when matched on vocabulary size. Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 189. Lee and colleagues found that not only was the growth of pragmatic skill in individuals with DS slower than TD peers, but that violations of some pragmatics skills increased marginally with age, while others decreased. Lee et al., "A Multi-Method Investigation," 12–13.

[215] Martin et al., "A Multimethod Analysis of Pragmatic Skills," 3032. Participants were assessed on measurements of "noncontingent language ((loosely related or tangential, as well as off-topic or irrelevant language), perseveration (excessive verbal self-repetition of a word, phrase, sentence, or topic), initiations (nonobligatory, self-initiated contributions), and nonresponsiveness (failure to respond when a response is obligatory)" (3024). It should be noted that in this study it was not possible to compare participants matched by MA, and thus analyses controlled for nonverbal MA and other language measurements (3026).

[216] Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 189. In the Berglund study, participants were matched on receptive vocabulary level. In particular, they found that individuals with DS talked about ownership, missing things, and understood talk about missing things less than TD controls (187). For evidence of pragmatic skills on par with or stronger than grammar, see Miles and Chapman, "Narrative Content," 175–89; Boudreau and Chapman, "Relationship between Event Representation and Linguistic Skill," 1146–59; McDuffie, Chapman, and Abbeduto, "Language Profiles of Adolescents and Young Adults," 117–42; Jane S. Leifer and Michael Lewis, "Acquisition of Conversational Response Skills by Young Down Syndrome and Nonretarded Young Children," *American Journal of Mental Deficiency* 88 no. 6 (1984): 610–18.

[217] For nonverbal communication see Smith, Næss, and Jarrold, "Assessing Pragmatic Communication," 19; Angela E. John and Carolyn B. Mervis, "Comprehension of the Communicative Intent behind Pointing and Gazing Gestures by Young Children with Williams Syndrome or Down Syndrome," *JSLHR* 53 no. 4 (2010): 950–60; Eliza Porto-Cunha and Suelly Cecilia Olivan Limongi, "Communicative Profile Used by Children with Down Syndrome," *Pró-Fono Revista de Atualização*

particularly impaired pragmatic skills include understanding context, signaling of noncomprehension, and effectively conveying one's intent.[218] Correlates of pragmatic skills in individuals with DS include executive functioning, general cognitive abilities, structural language abilities (such as speech production and syntax), and theory of mind.[219]

Language and cognition. Though individuals with DS have cognitive impairments, their language impairments exceed what would be expected given their levels of cognition.[220] For example, lexical development often lags behind cognitive development.[221] This is especially true for expressive lexical development and has also

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Científica 20 (2008): 243–48; Franco and Wishart, "Use of Pointing and Other Gestures," 160–82; For social communication see Laws and Bishop, "Pragmatic Language Impairment," 59; Coggins, Carpenter, and Owings, "Examining Early Intentional Communication," 98–106; Owens and MacDonald, "Communicative Uses of the Early Speech," 503–10. For event retelling see Boudreau and Chapman, "Relationship between Event Representation and Linguistic Skill," 1146–59; Miles and Chapman, "Narrative Content," 175–89; McDuffie, Chapman, and Abbeduto, "Language Profiles of Adolescents and Young Adults," 117–42. Event retelling strength seems to depend upon the availability of visual support. Miles, Chapman, and Sindberg, "Sampling Context Affects MLU," 325–37; Roberts, Price, and Malkin, "Language and Communication Development," 30; Martin et al., "Language Characteristics," 7. However, van Bysterveldt and Westerveld found that children with DS struggled with narrating personal past events, even with their own photos. van Bysterveldt and Westerveld, "Sharing Past Personal Event Narratives," 259.

[218] For context see Smith, Næss, and Jarrold, "Assessing Pragmatic Communication," 19; Laws and Bishop, "Pragmatic Language Impairment," 54. For noncomprehsion signaling see Gary E. Martin et al., "Signaling of Noncomprehension in Communication Breakdowns in Fragile X Syndrome, Down Syndrome, and Autism Spectrum Disorder," *JOCD* 65 (2017): 22–34; Abbeduto et al., "Signaling Noncomprehension of Language," 214–30. For conveying intent see Abbeduto et al., "Collaboration in Referential Communication," 170–83. In this study participants with DS showed great difficulty in describing an object to a listener whom the participant could not see.

[219] Lee et al., "A Multi-Method Investigation," 13–14; Laws and Bishop, "Pragmatic Language Impairment," 59. Theory of mind is the ability to reason about, predict, and explain the behavior of oneself and others, particularly when the other holds different beliefs than oneself, and is impaired in individuals with DS. See also Leonard Abbeduto et al., "The Linguistic and Cognitive Profile of Down Syndrome: Evidence from a Comparison with Fragile X Syndrome," *DSRP* 7, no. 1 (2001): 12–13.

[220] Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 761.

[221] Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 316. For differing results see Galeote et al., "The Development of Vocabulary," 192.

been found to be true for receptive lexical development, though not as consistently.[222] Despite other studies which demonstrate that expressive vocabulary development lags behind MA, when Galeote and colleagues combined gesture production with vocal production, they found no difference between children with DS and TD children and contend that the children with DS in their study "show no specific dissociation between cognitive and lexical development."[223] The wide variance in results among studies could likely be due to the variance in types of words and the formatting of the assessments.[224] However, even when compared to other populations with cognitive impairment, individuals with DS demonstrate a higher level of linguistic impairment "than would be predicted using their cognitive level."[225] The gap between linguistic performance and

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[222] Abbeduto et al., "The Linguistic and Cognitive Profile of Down Syndrome: Evidence from a Comparison with Fragile X Syndrome," *DSRP* 7, no. 1 (2001): 11–12; Abbeduto, Warren, and Conners, "Language Development," 250; Zampini and D'Odorico, "Lo sviluppo del vocabulario," 331–46. Chapman found vocabulary comprehension skills were comparable to MA while expressive were not. Chapman et al., "Language Skills: Production Deficits," 9. Bello, Onofio, and Caselli found that children with DS lagged behind MA-matched peers in both comprehension and production. Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 770.

[223] Miguel Galeote et al., "The Acquisition of Productive Vocabulary in Spanish Children with Down Syndrome," *Journal of Intellectual and Developmental Disability* 33, no. 4 (2008): 298. Vicari and colleagues likewise found no evidence for a dissociation between cognitive and lexical development in young children with DS. Vicari, Caselli, and Tonucci, "Asynchrony of Lexical and Morphosyntactic Development," 641.

[224] Leonard Abbeduto and Robin S. Chapman, "Language Development in Down Syndrome and Fragile X Syndrome: Current Research and Implications for Theory and Practice," in *Developmental Theory and Language Disorders*, ed. Paul Fletcher and Jon F. Miller, Trends in Language Acquisition Research 4 (Amsterdam: John Benjamins, 2005), 60; Abbeduto, Warren, and Conners, "Language Development," 250; Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 316. Not only did Galeote and colleagues include gestures in their measurement, but they also modified the assessment used from its original form to make adapt it to the developmental profile of individuals with DS. Galeote et al., "The Acquisition of Productive Vocabulary," 296. More research is needed to determine the effects of assessments and what types of measurement most accurately represent the abilities of individuals with DS. Chapman found that individuals with DS score higher on the PPVT-3 than the TACL-3 vocabulary test. Chapman, "Language Learning in Down Syndrome," 63–64.

[225] Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 316; Abbeduto, Warren, and Conners, "Language Development," 253. See, for example, Abbeduto et al., "The Linguistic and Cognitive Profile," 9–15; Chapman, "Language Learning in Down Syndrome," 63; Glynis Laws et al., "Receptive Vocabulary and Semantic Knowledge in Children with SLI and Children with Down Syndrome," *Child Neuropsychology* 21, no. 4 (2015): 490–508; Joanne Roberts et al.,

cognition is even more pronounced in measurements of grammar.[226] These results seem to reveal a general asynchrony between cognitive abilities and language abilities specific to individuals with DS.[227]

Bilingualism in DS

While to date there are no published studies of L2 acquisition in the FL context documenting FL acquisition among individuals with DS, much can be gleaned from research on bilingualism in individuals with DS.[228] However, the FL context is not identical to the bilingual context. Carmen Muñoz helps to clarify how the FL context may differ from the bilingual or naturalistic second language learning context. In the FL

"Receptive Vocabulary, Expressive Vocabulary, and Speech Production of Boys with Fragile X Syndrome in Comparison to Boys with Down Syndrome," *AJMR* 112, no. 3 (2007): 177–93; Paul J. Yoder and Steven F. Warren, "Early Predictors of Language in Children with and without Down Syndrome," *AJMR* 109, no. 4 (2004): 285–300. Interestingly, Loveall and colleagues found that on measurements of receptive vocabulary, individuals with DS performed below individuals with non-specific etiology intellectual disability when controlling for NVC and phonological memory, but above the TD group when controlling for the same. Loveall et al., "Receptive Vocabulary Analysis," 8. This may be due to the higher CA of the participants with intellectual disability (12–13).

[226] Vicari, Caselli, and Tonucci, "Asynchrony of Lexical and Morphosyntactic Development," 641.

[227] Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 770; Chapman et al., "Predicting Language Production," 347. However, research conducted by Facon and colleagues reveals that the strength of the relationship between vocabulary and cognition depends on the type of vocabulary (relational vs. general), with a greater effect found for relational vocabulary. They also argue that the trajectory of vocabulary development in relation to cognitive ability is similar, no matter the diagnosis of the individual. Bruno Facon, Yannick Courbois, and David Magis, "A Cross-Sectional Analysis of Developmental Trajectories of Vocabulary Comprehension among Children and Adolescents with Down Syndrome or Intellectual Disability of Undifferentiated Aetiology," *Journal of Intellectual and Developmental Disability* 41, no. 2 (2016): 146. Similarly, Berglund and colleagues found a similar growth pattern in various domains of language and suggest that growth patterns are common, independent of diagnosis. Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 188.

[228] Two studies (outside of the North American context) report on FL teaching to individuals with DS, though they focus on methods of teaching and assessment, not on FL acquisition by the students with DS. Hossein Talebzadeh and Mahvash Pourhanifeh, "Investigating Practical Knowledge-Base (PKB) of Special-Education Teachers: The Case of Teaching Individuals with Down Syndrome (IDS) in the English as a Foreign Language (EFL) Context of Iran," *Applied Research on English Language* 11, no. 2 (2022): 25–50 and Gholam-reza Abbasian and Fatemeh Ebrahimi, "Assessing Down Syndrome EFL Learner's Language Ability: Incorporating Learners-Teachers' Perspectives," *English Language Teaching* 13, no. 3 (2020): 45–67.

context (1) instruction is generally restricted to only two to four sessions of less than one hour per week (though in the elementary context, students generally receive much less),[229] (2) the main source of input is the teacher, and students may or may not be exposed to sufficient quantity or quality of input, (3) peers do not utilize the target language to communicate with each other, and (4) students are not exposed to the target language outside of the classroom.[230] Though differences between the context of the FL classroom and bilingualism should be acknowledged, it is beneficial to explore the findings of bilingualism in individuals with DS, as it is the closest context to FL learning researched to date in individuals with DS.

The field of research in bilingualism in DS was begun by two pioneering case studies which documented the abilities of individuals with DS to become bilingual.[231] Since then, various studies have emerged documenting the language abilities of bilingual individuals with DS, clearly demonstrating that individuals of DS are capable of becoming bilingual.[232] While the second language abilities of children with DS varies

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[229] Though meeting times and frequency vary greatly, some elementary programs may meet as little as twenty minutes once a week. Helena Curtain, Richard Donato, and Victoria Gilbert, "Elementary School Foreign Language Programs in the United States," in *Foreign Language Education in America: Perspectives from K–12, University, Government, and International Learning*, ed. Steven Berbeco (London: Palgrave Macmillan, 2016), 20.

[230] Carmen Muñoz, "Symmetries and Asymmetries of Age Effects in Naturalistic and Instructed L2 Learning," *Applied Linguistics* 29, no. 4 (2008): 578–79.

[231] Vallar and Papagno investigated the abilities of a young trilingual woman with DS. Giuseppe Vallar and Costanza Papagno, "Preserved Vocabulary Acquisition in Down's Syndrome: The Role of Phonological Short-Term Memory," *Cortex* 29, no. 3 (1993): 467–83. Interestingly, in a 2001 study on the same woman, they report that she is learning her fourth language, Spanish. Costanza Papagno and Giuseppe Vallar, "Understanding Metaphors and Idioms: A Single-Case Neuropsychological Study in a Person with Down Syndrome," *Journal of the International Neuropsychological Society* 7, no. 4 (2001): 517. The second pioneer study in the field is Woll and Grove conducted a case study on the abilities of bilingual twins. Bencie Woll and Nicola Grove, "On Language Deficits and Modality in Children with Down Syndrome: A Case Study of Twins Bilingual in BSL and English," *Journal of Deaf Studies and Deaf Education* 1, no. 4 (1996): 271–78. Though somewhat dated research, these case studies continue to be referenced widely in the literature.

[232] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in *Multilingual Perspectives on Child Language Disorders*, ed. Janet L. Patterson and Barbara L. Rodriguez

greatly, the general language profile of bilingual children with DS conforms to that of their monolingual peers with DS.[233] When assessed on various domains in the dominant language, they perform below their TD peers in most language measurements.[234] Like their monolingual peers with DS, bilingual children with DS exhibit strengths in receptive vocabulary and weaknesses in expressive language, especially morphosyntax, in both languages.[235] However, children with DS generally perform on par with their monolingual peers with DS in their dominant language.[236] This growing body of evidence

(Bristol, UK: Channel View, 2015), 53–54.

[233] Elizabeth Kay-Raining Bird et al., "The Language Abilities of Bilingual Children with Down Syndrome," *AJSLP* 14, no. 3 (2005): 194–96; Elizabeth Kay-Raining Bird, Fred Genesee, and Ludo Verhoeven, "Bilingualism in Children with Developmental Disorders: A Narrative Review," *JOCD*, Article in Press (2016): 7; Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," *Perspectives on Language Learning and Education* 16, no. 3 (2009): 92; Krista Feltmate and Elizabeth Kay-Raining Bird, "Language Learning in Four Bilingual Children with Down Syndrome: A Detailed Analysis of Vocabulary and Morphosyntax," *Canadian Journal of Speech-Language Pathology and Audiology* 32, no. 1, (2008): 16; Rebecca Ward and Eirini Sanoudaki, "Language Profiles of Welsh-English Bilingual Children with Down Syndrome," *JOCD* 93 (2021): 10; Dimitra Katsarou and Georgia Andreou, "Bilingualism in Down Syndrome: A Greek Study," *International Journal of Disability, Development and Education* 68, no. 3 (2021): 4.

[234] See, for example, Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 14–15. Interestingly, in a syntactic bootstrapping task experiment (to learn novel words) conducted by Cleave and colleagues, the monolingual group of children with DS performed further below the monolingual group of TD children than did the bilingual group of children with DS below the TD bilingual group. Patricia L. Cleave et al., "Syntactic Bootstrapping in Children with Down Syndrome: The Impact of Bilingualism," *JOCD* 49 (2014): 50. It is important to note that in the studies of language development in children with DS, including studies of bilingualism in DS, participants with DS are compared to developmentally matched controls. The controls are matched with participants on MA, not CA. Thus, when referring to TD controls, "peers" refers to developmentally matched, not chronologically matched, peers, and participants with DS are typically chronologically older than TD controls.

[235] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 195; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 92; Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 17; Ward and Sanoudaki, "Language Profiles," 11; Katsarou and Andreou, "Bilingualism in Down Syndrome," 5.

[236] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196; Rebeca A. N. Valdivia, "Documenting the Communicative Competence of Bilingual Preschoolers with Down Syndrome" (PhD diss., University of Illinois at Urbana-Champaign, 2005), 159; Feltmate and Bird found varied individual differences across all measurements and contend that the absence of any pattern of differences suggests that the introduction of an L2 is not detrimental to L1 development. Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 15.

suggests that exposure to a second language in the bilingual context is not harmful to the L1 development of children with DS, as long as the L1 continues to receive adequate support.[237]

In their second language, bilingual children with DS generally perform as well as TD bilingual controls matched on developmental level on measures of receptive vocabulary, suggesting that children with DS may be able to "(acquire) second-language vocabulary skills on par with" bilingual TD developing children with the same nonverbal cognitive abilities.[238] Ward and Sanoudaki note that though their bilingual participants with DS performed on par with the TD bilingual participants matched for nonverbal cognitive ability in measures of receptive vocabulary, they performed "significantly lower" on measures of expressive vocabulary.[239] This is to be expected given the difficulties in expressive language typical of individuals with DS. Bilingual children with DS are equally capable of learning novel words as are their monolingual peers matched on NVC with DS.[240]

Neither bilingualism nor exposure to a second language poses a disadvantage to the cognitive development of individuals with DS.[241] Moreover, some research

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[237] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 94; Kay-Raining Bird, "The Case for Bilingualism," 266; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 197; Natacha Trudeau et al., "Développement lexical chez les enfants bilingues avec Trisomie 21," *Enfance* 3, no. 3 (2011): 398, 400; Katsarou and Andreou, "Bilingualism in Down Syndrome," 4–5. Feltmate and Kay-Raining Bird nuance the understanding that bilingualism does not disadvantage the L1 inferring that evidence demonstrates this is true when the L1 is the child's dominant language, or the two languages are balanced. Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 19. Further research is needed for other contexts.

[238] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196. The authors caution that a "small sample size may have masked significant differences" (196). Trudeau and colleagues suggest similar results in their study of bilingual infants with DS. Trudeau et al., "Développement lexical chez les enfants," 399–400.

[239] Ward and Sanoudaki, "Language Profiles," 11.

[240] Cleave et al., "Syntactic Bootstrapping," 51.

[241] Jamie O. Edgin et al., "Neuropsychological Effects of Second Language Exposure in Down

suggests that bilingualism may offer benefits for individuals with DS. For example, Feltmate and Kay-Raining Bird found that bilingual children with DS were shown to have a larger overall vocabulary than monolingual children with DS matched on nonverbal MA.[242] In the syntactic bootstrapping task conducted by Cleave and colleagues, bilingualism was not disadvantageous to children with DS, but neither did it offer any advantage. They propose that if a different type of task were used, one in which participants must ignore competing information to complete the task, the benefits of bilingualism may manifest themselves.[243] Kay-Raining Bird suggests that metalinguistic advantages may exist for bilingual individuals with DS, but sufficient research has yet to be conducted.[244] However, in their single case study of a bilingual-biliterate child with DS, Burgoyne and colleagues found no metalinguistic benefits conferred from bilingualism.[245] Additionally, Ward and Sanoudaki found no advantages in phonological awareness conferred by bilingualism in children with DS. The authors suggest that this may be due to the bilingual context in Wales, or to the young MA and CA of the participants.[246] Thus, while it is possible that bilingualism may offer metalinguistic benefits to bilinguals with DS, this area clearly requires more research.

Several factors seem to correlate significantly with second language

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Syndrome," *JIDR* 55, no. 3 (2011): 351–56; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 187–99; Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 8; Mirko Uljarević et al., "Practitioner Review: Multilingualism and Neurodevelopmental Disorders–an Overview of Recent Research and Discussion of Clinical Implications," *Journal of Child Psychology and Psychiatry* 57, no. 11 (2016): 1205–17.

[242] Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 16.

[243] Cleave et al., "Syntactic Bootstrapping," 51.

[244] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 93.

[245] Kelly Burgoyne et al., "Bilingualism and Biliteracy in Down Syndrome: Insights from a Case Study," *Language Learning* 66, no. 4 (2016): 961.

[246] Ward and Sanoudaki, "Language Profiles," 11.

development in bilingual children with DS, including working memory, NVC (often calculated as MA), CA, input, and phonological awareness.[247] According to a study by Ward and Sanoudaki, the strongest of these factors may be working memory, particularly for receptive skills.[248] However, other studies which explored factors related to L2 development in bilingual children with DS did not examine working memory, and further research is needed to draw clear conclusions on which factors most strongly correlate with L2 development. MA seems to be another factor of considerable significance.[249] In their study on bilingualism in children with DS, Kay-Raining Bird and colleagues found that the participant with the highest MA also scored the highest on all measures of language ability in both languages among the bilingual participants with DS.[250] However, a low MA does not necessarily preclude a child with DS from becoming bilingual, as the child in this same study with the lowest MA also demonstrated evidence of second language skills.[251] Ward and Sanoudaki argue that the role of NVC in language development of bilingual children with DS is not as significant as in the TD population.[252] CA, though not as robustly as MA, also plays a role in second language development in bilingual children with DS, especially grammar.[253]

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247 Ward and Sanoudaki found that working memory, NVC, CA, and phonological awareness accounted for 90 percent of the variation in DS groups. Ward and Sanoudaki, "Language Profiles," 11. See also Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 53, 60.

248 Ward and Sanoudaki, "Language Profiles," 11–12.

249 Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196.

250 Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196. Similarly, in another study, the child with the highest MA and CA scored the highest of all bilingual participants with DS on all language measurements. Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 18–19.

251 Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196.

252 Ward and Sanoudaki, "Language Profiles," 12.

253 Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 195–96.

Despite the evidence for a strong link between MA and language development, MA alone cannot guarantee language development without sufficient input. Feltmate and Kay-Raining Bird found in their study of four bilingual children with DS that the child with the second-highest MA scored the lowest on all measures of the L2 (French), likely due to limited exposure.[254] Progress in the L2 seems especially sensitive to amount and frequency of exposure, even more so than the L1.[255] In the bilingual context, the amount of input seems to be even more significant than duration of exposure.[256] While many factors play into the success of bilingualism in individuals with DS, the evidence makes clear that individuals with DS can indeed become bilingual.

Not only can children with DS become bilingual, but they can also become biliterate. Kelly Burgoyne and colleagues conducted a case study on a bilingual child with DS ("MB") who is proficient in both Russian (L1) and English (L2).[257] Despite the vast differences in the two alphabets, MB demonstrated reading abilities in both languages. In English, her L2, she performed on par with her peers matched on word-reading ability (both with and without DS) in measurements of word reading, though her reading comprehension fell below that of her TD peers, typical for children with DS.[258] In Russian, her L1, MB performed on par with the TD control group in some, but not all, of the measurements, despite not having received formal reading instruction in Russian, unlike the control group. While not all children with DS may be able to attain the levels

[254] Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 18.

[255] Trudeau et al., "Développement lexical chez les enfants," 399; Ward and Sanoudaki, "Language Profiles," 12.

[256] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196; Ward and Sanoudaki, "Language Profiles," 12; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 60.

[257] Burgoyne et al., "Bilingualism and Biliteracy in Down Syndrome," 945–71.

[258] Unlike other studies in language development in children with DS, MB was matched not on MA but on word-reading ability.

of biliteracy which MB demonstrates, MB is a clear example of a child with DS who has achieved relative success in becoming both bilingual and biliterate.[259]

One case study examines the abilities of a child with DS in the French immersion context in Canada. Martin and colleagues document the language abilities of Jake, a middle-school boy who entered French immersion in third grade.[260] Jake was assessed in grades six and eight on French and English language and reading abilities. At both testing times, Jake's English abilities (L1) were stronger than his French (L2). Except for one measurement (*Concepts and Following Directions*), Jake's English language and reading scores continued to improve while in French immersion. After four years of French immersion (Time 1), Jake had attained French language capabilities equivalent to that of a TD monolingual four- or five-year-old, and French reading abilities in the six-to-seven-year-old range. However, with the exception of one measurement (*Concepts et Exécution de Directives*), Jake did not improve in his French abilities from Time 1 to Time 2.[261]

When compared to a group of monolingual English-speaking students with DS matched for CA at Time 2, Jake scored higher than all but one of the participants on all measures of English language and reading.[262] Though Jake scored higher than the mean of the monolingual group on all measurements, this only reached statistical significance for the *Recalling Sentences* subtest. Better abilities in this child with DS compared to

[259] Though not to the same degree, an earlier case study also suggests that individuals with DS can become biliterate. Vallar and Papagno, "Preserved Vocabulary Acquisition," 467–83.

[260] Sarah Martin et al., "Bilingual Outcomes for a Student with Down Syndrome in French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 1–29.

[261] It is interesting to note that the same measurement in which he did not improve in English, he did improve in French. This could be related to the environment where he was exposed to the two languages.

[262] All participants in the control group were within three years of Jake's CA. Martin et al., "Bilingual Outcomes," 7.

age-matched monolinguals with DS could be due to a metalinguistic bilingual advantage, but the evidence is not clear, and further research is needed.[263] In addition to the standardized measurements, it was also reported that Jake could successfully code-switch and use the French language both in the classroom and the community. Jake is another clear example of a bilingual/biliterate individual with DS, but one who did not receive exposure to the L2 until much later in childhood.

L2 Learning in DLD and Learning Disabilities

Though the cognitive and language profiles of individuals with DS do not conform to that of any specific language or intellectual disability, such are the closest populations with research available on L2 acquisition in the FL context. Though research on bilingualism and L2 learning in developmental disabilities is sparse, far more research on bilingualism has been conducted on children with DLD and developmental disabilities than children with DS.[264] However, only a few have been conducted in the FL context. Given the dearth of research on FL learning in children with developmental and learning disabilities and DLD, this section will review a sampling of the literature on L2 learning in these populations first in the immersion context, followed by a full review of the literature in the FL context.

Kay-Raining Bird and colleagues document in some detail the academic abilities of English-speaking children with special education needs in an inclusive Early

[263] Martin et al., "Bilingual Outcomes," 23.

[264] Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 11; Elizabeth Kay-Raining Bird, Natacha Trudeau, and Ann Sutton, "Pulling it All Together: The Road to Lasting Bilingualism for Children with Developmental Disabilities," *JOCD* 63 (2016): 65; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 67; Johanne Paradis, "An Agenda for Knowledge-Oriented Research on Bilingualism in Children with Developmental Disorders," *JOCD* 63 (2016): 83.

French Immersion (EFI) program.[265] Participants had a variety of communicative, behavioral, learning, intellectual and/or physical disabilities, though it does not seem that any of the participants had DS. Children began EFI in kindergarten and completed province-wide tests at the end of third grade in English on academic measurements of reading, writing, and math and were compared to same-age peers enrolled in an English Language of Instruction (ELoI) program. The majority of the students in EFI with disabilities met the provincial standards of reading, writing, and math, surpassing the percentage of ELoI students with disabilities that met the standards. However, it appears that overall, those students participating in EFI had "less severe learning difficulties" than those participating in ELoI.[266] EFI participants "were able to achieve functional French language and reading skills after only 3 years of French Immersion," and with the exception of one student, all participants demonstrated "French language abilities at or above a four-year-old level and French word reading skills at or above a six-and-a-half-year-old level."[267] Other studies found similar results, suggesting that many children with various intellectual, language, and learning disabilities can acquire an L2 in the dual-language setting without detrimental effects to the L1.[268]

Regarding L2 acquisition in the FL context, one study investigates the abilities of children with special education needs, while two investigate the abilities of children

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[265] Elizabeth Kay-Raining Bird et al., "Access and Outcomes of Children with Special Education Needs in Early French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 1–30.

[266] Kay-Raining Bird et al., "Access and Outcomes," 24.

[267] Kay-Raining Bird et al., "Access and Outcomes," 25. It is important to note the possible effect of selection bias in these results, "as only a small subset of parents chose to have their child with SEN participate in direct testing" (24).

[268] Marjorie L. Myers, "Achievement of Children Identified with Special Needs in Two-Way Spanish Immersion Programs" (PhD diss., George Washington University, 2009); Fred Genesee and Tara W. Fortune, "Bilingual Education and At-Risk Students," *Journal of Immersion and Content-Based Language Education* 2, no. 2 (2014): 198–99.

with DLD. Peker and Regalla examine L1 and L2 development of pre-kindergarteners with and without special needs in an inclusive FL program.[269] The special needs included developmental delays, language impairments, social/emotional disorders, and autism spectrum disorder. Students in the study participated in thirty-minute French classes twice a week for two school years. Instruction was based upon an animated video series, and included interactive activities such as TPR, games, and songs. Students were assessed on French (L2) vocabulary based on the FL classroom curriculum, English (L1) vocabulary based on the FL classroom curriculum, and standardized measurements of English vocabulary. As would be expected, TD students scored higher than students with special needs on all measurements in both languages, reaching significance on French classroom assessments and English standardized assessments. However, all students, with and without special needs, demonstrated evidence of L2 vocabulary acquisition. Additionally, all students improved in their English vocabulary skills from the pre-test to the post-test, suggesting that L2 exposure does not impede development in the L1, even for students with special needs. This study also demonstrates the ability of students with various language and developmental disabilities to acquire L2 vocabulary in the FL context.

Zoutenbier and Zwitserlood were the first to investigate FL learning in children with DLD.[270] Sixth-grade Dutch students began learning English as a FL in fifth grade and received thirty to forty-five minutes of instruction weekly. Students came from various schools for children with DLD in the Netherlands, and the methods of instruction varied. Students were assessed on various Dutch and English language skills. The method

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[269] Hilal Peker and Michele Regalla, "Making Exemption the Exception, Not the Rule: Inclusion of All Students in Foreign Language Education," *Foreign Language Annals* 54, no. 1 (2021): 73–90.

[270] Inge Zoutenbier and Rob Zwitserlood, "Exploring the Relationship between Native Language Skills and Foreign Language Learning in Children with Developmental Language Disorders," *Clinical Linguistics & Phonetics* (February 2019): 1–13.

of assessment for the English language test was a multiple-choice paper and pencil test which measured listening skills, auditory vocabulary, reading skills, and written vocabulary. While participants came from both multilingual and monolingual backgrounds, they did not differ significantly in their performance on the English language assessment. The majority of the participants performed "poorly" when compared to TD children as measured by norm-referenced scores, and the authors suggest that children with DLD may not be able to learn a FL due to their "poor word decoding skills and impaired morphosyntactic skills in their first language."[271] However, the assessment largely depended on reading, and participants had a limited response time for the auditory sections. Modifications were not offered for the participants, despite the fact that children with DLD have language deficits, and the authors themselves admit the test may have not been the most appropriate for children with DLD.[272] Additionally, the study revealed that performance in Dutch and English were related, and the authors suggest that children with DLD first build strong L1 skills before beginning to learn a FL.[273]

Tribushinina and colleagues investigated the English FL acquisition of children with DLD in Russia and compared them to TD controls matched for classroom English FL exposure.[274] As opposed to Zoutenbier and Zwitserlood, they utilized methods of assessment more amenable to children with DLD for English measurements, namely picture matching tasks. Assessments were administered three times: after one year of English language instruction, the midpoint of year two, and at the end of year two. After

[271] Zoutenbier and Zwitserlood, "Exploring the Relationship," 11.

[272] Zoutenbier and Zwitserlood, "Exploring the Relationship," 10.

[273] Zoutenbier and Zwitserlood, "Exploring the Relationship," 11.

[274] Elena Tribushinina, Elena Dubinkina-Elgart, and Nadezhda Rabkina, "Can Children with DLD Acquire a Second Language in a Foreign-Language Classroom? Effects of Age and Cross-Language Relationships," *JOCD* 88 (2020): 1–17.

one year in the FL class, participants with DLD and TD participants did not differ in their receptive English vocabulary skills. However, the TD children progressed well beyond the children with DLD in receptive vocabulary skills after one-and-a-half and two years of instruction. Though in the initial analysis, TD children surpassed the children with DLD on measurements of receptive English grammar after one year of instruction, upon controlling for outside exposure to English, both groups performed similarly. Nonetheless, similar to vocabulary, TD participants showed much greater improvement in grammar than participants with DLD in the second year of classes. Based on these results the authors contend that ninety minutes a week of instruction is insufficient for children with DLD to make progress in a FL.[275] However, it is significant to note that all children showed evidence of acquisition, and differing methods of instruction and greater outside exposure to the language may bolster the FL abilities of children with DLD.[276]

Instructional methods for L2 learning. One formidable barrier to individuals with DS and other language and/or learning disabilities participating in the FL classroom is the lack of training and resources for teachers.[277] Teachers are often not adequately trained to effectively include such students in the FL classroom, and what research that exists is not readily available to teachers.[278] This section will provide a brief overview of

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[275] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 13.

[276] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 13.

[277] Katy Arnett and Callie Mady, "A Critically Conscious Examination of Special Education within FSL and its Relevance to FSL Teacher Education Programs," *Canadian Journal of Applied Linguistics* 13, no. 1 (2010): 29–30. The same is true for bilingual education and children with intellectual disabilities. Jean Ware, Catrin Bethan Lye, and Fliss Kyffin, "Bilingualism and Students (Learners) with Intellectual Disability: A Review," *Journal of Policy and Practice in Intellectual Disabilities* 12, no. 3 (2015): 225.

[278] Callie Mady and Stefanie Muhling, "Instructional Supports for Students with Special Education Needs in French as a Second Language Education: A Review of Canadian Empirical Literature," *Journal of Education and Learning* 6, no. 3 (2017): 14; Wendy Carr, *Teaching Core French in*

the available literature pertaining to instructional methods and strategies for children with language, learning, or developmental disabilities for L2 learning, focusing on the middle school years and below.

Mady and Muhling reviwed literature pertaining to supporting students with special education needs in French as a second language education. No reviewed studies addressed instruction in the elementary FL context, and none addressed individuals with DS. The review also reveals the dearth of resources in this area, especially in the FL context.[279] However, the review identified helpful strategies such as the use of gestures, visual supports, use of the target language, and group work/peer support to support L2 learning for children with special education needs. In a separate article, Emily Duvall offers tips on how to make classroom modifications and accommodations for students with disabilities in the FL classroom.[280] While such an article is helpful, it does not equip FL teachers with specific instructional strategies to deliver the language to students with disabilities.[281]

One the most helpful resources for FL teachers of children with special

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British Columbia: Teachers' Perspectives. Research Report for British Columbia Association of Teachers of Modern Languages, 2007. https://www.bcatml.org/research--reports.html; Paradis, "An Agenda for Knowledge-Oriented Research," 80; Arnett and Mady, "Exemption and Exclusion," 95; Julie Longard and Hélène Deacon, "Bilingualism in Children with Down Syndrome," *Literacy Today* (June 2009): 30; Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 11.

[279] Mady and Muhling, "Instructional Supports for Students with Special Education Needs," 14–22. Peker and Regalla also note that the majority of studies on the integration of students with special needs in the FL classroom have been conducted at the high school level or college levels. Peker and Regalla, "Making Exemption the Exception," 75.

[280] Emily D. Duvall, "Including Students with Disabilities in a Foreign Language Class," *Teaching Exceptional Children* 38, no. 6 (2006): 42–48.

[281] Similarly, in her review of the literature on students with learning disabilities in the FL learning environment, Wight notes that much research focuses on modifications and accommodations which can be made to aid students with learning disabilities. Mary Caitlin S. Wight, "Students with Learning Disabilities in the Foreign Language Learning Environment and the Practice of Exemption," *Foreign Language Annals* 48, no. 1 (2015): 48–50. Her review likewise does not provide specific instructional strategies for delivering input.

education needs to date is a study conducted by Joy and Murphy.[282] Joy and Murphy describe an integrated intensive French as a second language immersion program in which students of various learning and developmental disabilities, including at least one child with DS, underwent five months of French instruction for three hours a day along with TD peers. They emphasized the unique nature of the program as one which utilized an "authentic and integrated focus on implicit language learning with language as a means of communication."[283] All instruction took place in the L2 (French), and teachers used strategies such as music, drama, and easy to read books which children take home with them to deliver content. Teaching techniques such as scaffolding, modeling, repetition, and pictures for comprehension support were employed. Learning was cross-curricular, active, hands-on, and activity based, and students often worked in groups. Though no statistical data is available, they report that at the end of the program, "many students with (special educational needs) can do basic communication in the French language and have a positive attitude towards French," demonstrating the ability of children with learning disabilities to begin to acquire an L2, even in a short period of time, given the appropriate environment and instructional support.[284]

Two case studies highlight specific strategies which may help students with learning and/or intellectual disabilities learn L2 vocabulary in the FL context. Roberto Olmeda Casanova documented the effectiveness of music to help an eight-year-old Spanish-speaking child with DS learn vocabulary in English. In a targeted intervention outside of the FL classroom, the participant was introduced to vocabulary through songs and corresponding images. After six weeks of treatment for thirty-minutes, three times a

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[282] Rhonda Joy and Elizabeth Murphy, "The Inclusion of Children with Special Educational Needs in an Intensive French as a Second-Language Program: From Theory to Practice," *Canadian Journal of Education* 35, no. 1 (2012): 102–19.

[283] Joy and Murphy, "The Inclusion of Children with Special Educational Needs," 106.

[284] Joy and Murphy, "The Inclusion of Children with Special Educational Needs," 112.

week, the student correctly identified 81 percent of the targeted items, suggesting that music with targeted vocabulary could be an effective strategy for teaching L2 vocabulary in the FL context to children with DS.[285]

Barwasser and colleagues implemented a strategy of storytelling, supplemented with vocabulary flash cards, and self-graphing score cards for participants to keep track of their learning.[286] The four seventh-grade girls with learning disabilities examined in this study steadily improved in their vocabulary recognition throughout the duration of the intervention, with two participants correctly identifying all thirty words at the end of the intervention. After two weeks, the majority of the learned words had been retained by all four participants. While it is apparent that this combination of strategies was successful to aid the students in learning FL vocabulary, due to the nature of methodology, it is unclear which of these strategies contributed to the most learning. Though some research exists on instructional methods to support children with learning or intellectual disabilities in the FL classroom, much is lacking, and almost no research is geared specifically toward children with DS.

Factors in L2 Acquisition

This section will provide an overview of factors which affect L2 acquisition or correlate with L2 acquisition in children. Special attention will be given to the FL context as well as those factors which may have an augmented impact on individuals with DS due to their relationship to the developmental profile of individuals with DS. Factors which may affect L2 acquisition may be divided into those which are internal to the learner and those which are external. Internal factors pertinent to the FL context include

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[285] Roberto Olmeda Casanova, "The Effect of Using Music as a Socio-Affective Strategy to Teach English to a Second Grade Down Syndrome Student" (EdD diss., University of Puerto Rico, 2012).

[286] Anne Barwasser, Turid Knaak, and Matthias Grünke, "The Effects of a Multicomponent Storytelling Intervention on the Vocabulary Recognition of Struggling English as a Foreign Language Learners with Learning Disabilities," *Insights into Learning Disabilities* 17, no. 1 (2020): 35–53.

age of onset (how old the child is when they begin learning the L2), short-term memory, NVC, analytic reasoning, CA (as representing cognitive maturity) and knowledge of another language. External factors include input quantity, input quality, length of exposure to the language, outside exposure to the language, and social economic status.[287] Though all of the aforementioned factors play a role in L2 acquisition, the actual picture is quite complex. What follows is an overview of the most salient factors in child L2 acquisition, and those most pertinent to the DS population.

Though it is commonly thought that "the earlier the better" for FL learning, this notion is not entirely supported by research.[288] While an earlier start poses various potential benefits for L2 learning, older learners generally learn at a faster rate than younger learners and may reap greater benefits in the long run.[289] Jasone Cenoz found that with the same number of hours of FL instruction, late starters outperformed early starters in almost every measurement of English proficiency.[290] In their study between

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[287] He Sun et al., "Individual Differences in Very Young Children's English Acquisition in China: Internal and External Factors," *Bilingualism: Language and Cognition* 19, no. 3 (2016): 551–52; Sharon Unsworth, Aafke Hulk, and Theodoros Marinis, "Internal and External Factors in Child Second Language Acquisition: Introduction," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 207; Johanne Paradis, "Individual Differences in Child English Second Language Acquisition: Comparing Child-Internal and Child-External Factors," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 214–18.

[288] Muñoz provides an extended chart which overviews the literature and shows vast discrepancies in results regarding age of onset in relation to L2 learning. Carmen Muñoz, "Age-Related Differences in Foreign Language Learning. Revisiting the Empirical Evidence," *International Review of Applied Linguistics in Language Teaching* 46 (2008): 210–17. Though somewhat outdated, Marinova-Todd and colleagues provide a helpful overview of literature which does not support the idea that older learners cannot successfully learn an L2. Stefka H. Marinova-Todd, D. Bradford Marshall, and Catherine E. Snow, "Three Misconceptions about Age and L2 Learning," *TESOL Quarterly* 34, no. 1 (2000): 9–34. See also Muñoz, "Symmetries and Asymmetries of Age Effects," 578–96.

[289] Nils Jaekel et al., "From Early Starters to Late Finishers? A Longitudinal Study of Early Foreign Language Learning in School," *Language Learning* 67, no. 3 (2017): 634, 649; Muñoz, "Symmetries and Asymmetries of Age Effects," 579.

[290] Jasone Cenoz, "The Influence of Age on the Acquisition of English: General Proficiency, Attitudes and Code-Mixing," in *Age and the Acquisition of English as a Foreign Language*, ed. María del Pilar García Mayo and María Luisa García Lecumberri (Bristol, UK: Multilingual Matters, 2003), 89. It should be noted that in the study conducted by Cenoz, learners were studying English as a third language. Lecumberri and Gallardo analyzed data from the same study as Cenoz and found similar advantages for

two cohorts, Jaekel and colleagues found that though the early start cohort initially outperformed the late start cohort, this gap eventually closed and at the final data collection the late start cohort outperformed the early start cohort on measures of reading and listening comprehension.[291] Many other studies reveal the advantages of L2 learning afforded by later age of onset for both TD children and children with DLD.[292] Age may be an even more crucial factor for children with DLD learning a second language than TD children.[293] It should be taken into account, however, that the majority of these studies do not measure final L2 learning, which could result in differing outcomes.[294]

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later age of onset for English sound perception and pronunciation. María Luisa García Lecumberri and Francisco Gallardo, "English FL Sounds in School Learners of Different Ages," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 115–35. In a similar study of English as a third language among Catalan-Spanish speakers, Muñoz found that later age of onset did provide some advantages to oral skill development, though not unambiguously. Carmen Muñoz, "Variation in Oral Skills Development and Age of Onset," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 161–81. See also Carmen Muñoz, "The Effects of Age on Foreign Language Learning: The BAF Project," in *Age and the Rate of Foreign Language Learning*, ed. Carmen Muñoz, Second Language Acquisition 19 (Bristol, UK: Multilingual Matters, 2006), 1–40.

[291] Jaekel et al., "From Early Starters to Late Finishers?," 645–47.

[292] See Sun et al., "Individual Differences," 561; María del Pilar García Mayo, "Age, Length of Exposure and Grammaticality Judgements in the Acquisition of English as a Foreign Language," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 94–114; Vasiliki Chondrogianni and Theodoros Marinis, "Differential Effects of Internal and External Factors on the Development of Vocabulary, Tense Morphology and Morpho-Syntax in Successive Bilingual Children," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 337; Simone E. Pfenninger and David Singleton, "Affect Trumps Age: A Person-In-Context Relational View of Age and Motivation in SLA," *Second Language Research* 32, no. 3 (2016): 311–45; Carmen Muñoz, ed. *Age and the Rate of Foreign Language Learning*. Second Language Acquisition, 19 (Bristol, UK: Multilingual Matters, 2006). In their investigation of FL learning in children with DLD, Tribushinina and colleagues found a later age of onset beneficial for vocabulary development, but not grammar. This may be due to the floor effect of L2 grammar development in the children with DLD, and further exposure to the language would be needed to determine the effects of age of onset. Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14. Though they do not have empirical data to support it, Zoutenbier and Zwitserlood suggest that a later age of onset is best for children with DLD so that they can have sufficient time to develop strong L1 skills. Zoutenbier and Zwitserlood, "Exploring the Relationship," 11.

[293] Elma Blom and Johanne Paradis, "Sources of Individual Differences in the Acquisition of Tense Inflection by English Second Language Learners with and without Specific Language Impairment," *Applied Psycholinguistics* 36, no. 4 (2015): 971–72.

[294] Shiro Ojima et al., "Age and Amount of Exposure to a Foreign Language during Childhood: Behavioral and ERP Data on the Semantic Comprehension of Spoken English by Japanese

The later age of onset advantage may not be entirely attributable to age. As Jaekel and colleagues point out, "a crucial distinction needs to be made between age of onset and amount of exposure."[295] This distinction is especially important in the FL context, where exposure in the classroom is much more limited than the immersion or naturalistic setting.[296] For example, Ojima and colleagues found that any advantage of an earlier age of onset in FL learning disappeared after controlling for hours of exposure to the L2, noting that "longer hours of exposure," rather than an earlier age of onset, "led to significantly higher English proficiency."[297] Similarly, Mihaljević Djigunović and colleagues compared a cohort of Hungarian students studying English as a FL to their Croatian peers and found that though the Hungarian cohort had an earlier age of onset, they failed to outperform the Croatian cohort, despite more frequent teaching times and smaller class size. This seeming anomaly may be accounted for by poorer quality of English language instruction and less quality outside exposure to the language experienced by the Hungarian cohort. The authors conclude that factors such as an early start cannot guarantee better outcomes, and other crucial variables like instruction quality

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Children," *Neuroscience Research* 70, no. 2 (2011): 204; Pfenninger and Singleton, "Affect Trumps Age," 336. Muñoz notes the importance of this caveat, pointing out that final attainment is a very difficult thing to measure in the FL context. Muñoz, "Symmetries and Asymmetries of Age Effects," 583. One notable study which investigates effects of age of onset and attainment at the end of normal schooling found that an early age of onset does not necessarily result in higher performance. Other crucial factors in attainment are the type of learning and amount and intensity of input. Simone E. Pfenninger, "The Misunderstood Variable: Age Effects as a Function of Type of Instruction," *Studies in Second Language Learning and Teaching* 4, no. 3 (2014): 529–56.

[295] Jaekel et al., "From Early Starters to Late Finishers?," 633.

[296] Jaekel et al., "From Early Starters to Late Finishers?," 634; Ojima et al., "Age and Amount of Exposure," 203; María del Pilar García Mayo and María Luisa García Lecumberri, introduction to *Age and the Acquisition of English as a Foreign Language*, vii. For a thorough analysis of the difference between a naturalistic L2 learning setting and the FL setting, and its implications for age of onset, see 578–96. Muñoz clarifies that the "influence of age of L2 learning may be moderated by the learning context." Muñoz, "Revisiting the Empirical Evidence," 199.

[297] Shiro Ojima et al., "Age and Amount of Exposure to a Foreign Language during Childhood: Behavioral and ERP Data on the Semantic Comprehension of Spoken English by Japanese Children," *Neuroscience Research* 70, no. 2 (2011): 203.

and exposure to the language must be taken into account.[298] Muñoz summarizes the findings related to age of onset and exposure to the language well when she states that "an early start leads to success *but only provided that it is associated with enough significant exposure*."[299]

While ample evidence exists of the many advantages in L2 learning for late starters, this does not necessarily imply that children should begin learning an L2 at a later age, as L2 exposure poses many other benefits to children. Carolyn and Lafayette found that those students participating in a FL program outperformed their peers on all academic measurements.[300] Thus, age of onset is simply one of many factors to be considered in L2 learning. In fact, an earlier age of onset may be one of the most effective ways to increase hours of exposure, potentially more important to L2 acquisition than age of onset.[301]

Length of exposure is a crucial factor for successful L2 acquisition, and it seems that "the longer the exposure to the L2, the more native-like L2 performance becomes."[302] However, length of exposure alone is not always sufficient. As

[298] Jelena Mihaljević Djigunović, Marianne Nikolov, and István Ottó, "A Comparative Study of Croatian and Hungarian EFL Students," *Language Teaching Research* 12, no. 3 (2008): 433–52. For similar conclusions regarding other important factors besides age, see David Singleton, "Critical Period or General Age Factor(s)?," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 3–22, especially the conclusion. See also Jonathan Leather, "Phonological Acquisition in Multilingualism," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 23–58, in specific relation to phonology and Stefka H. Marinova-Todd, "Know Your Grammar: What the Knowledge of Syntax and Morphology in an L2 Reveals about the Critical Period for Second/Foreign Language Acquisition," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 59–73, in relation to grammar.

[299] Muñoz, "Symmetries and Asymmetries of Age Effects," 591. For a salient example, see Pfenninger, "The Misunderstood Variable," 529–56.

[300] Carolyn Taylor and Robert Lafayette, "Academic Achievement through FLES: A Case for Promoting Greater Access to Foreign Language Study among Young Learners," *The Modern Language Journal* 94, no. 1 (2010): 22–42.

[301] Ojima et al., "Age and Amount of Exposure," 204. See also Jaekel et al., "From Early Starters to Late Finishers?," 635.

[302] García Mayo, "Age, Length of Exposure and Grammaticality Judgements," 103. See also

demonstrated in previously mentioned studies, also crucial are frequency, quantity, and quality of exposure.[303] Sun and colleagues found external factors, particularly quantity of input, to be a more significant predictor of L2 vocabulary in the FL context than internal factors such as age of onset or short-term memory in a TD population.[304] Anne Vermeer found that vocabulary acquisition is "strongly related to the frequency of language input," so much so that frequency of input, whether written or oral, "(explains) half the variance or more."[305] Repetition of words has a significant effect on acquisition, and incidental acquisition of novel vocabulary words in an L2 requires multiple exposures to the word, somewhere between ten to twenty or even more.[306]

Closely related to quantity of exposure is quality of exposure, or what Paradis refers to as the "richness of the (L2) environment."[307] While the quality of L2 input can vary in any situation, the variation in the FL classroom is especially salient, and can considerably impact L2 acquisition. Kersten and colleagues found that teacher behavior,

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Chondrogianni and Marinis, "Differential Effects of Internal and External Factors," 338–39.

[303] Muñoz, "Symmetries and Asymmetries of Age Effects," 584; Carmen Muñoz, "Contrasting Effects of Starting Age and Input on the Oral Performance of Foreign Language Learners," *Applied Linguistics* 35, no. 4 (2014): 1–21.

[304] Sun et al., "Individual Differences," 560. See also Ojima et al., "Age and Amount of Exposure," 197–205. Graham and colleagues found quantity of exposure to the language in the classroom (teaching time) to be especially important in the elementary years. Suzanne Graham et al., "Early Language Learning: The Impact of Teaching and Teacher Factors," *Language Learning* 67, no. 4 (2017): 950. Cumulative exposure, not age of onset, was also found to be a key factor in L2 vocabulary development of sequential bilinguals with DLD, a population often compared individuals with DS for language development. Sini Smolander et al., "L2 Vocabulary Acquisition of Early Sequentially Bilingual Children with TD and DLD Affected Differently by Exposure and Age of Onset," *IJLCD* 56, no. 1 (2021): 102–16.

[305] Anne Vermeer, "Breadth and Depth of Vocabulary in Relation to L1/L2 Acquisition and Frequency of Input," *Applied Psycholinguistics* 22, no. 2 (2001): 230.

[306] Stuart Webb, "The Effects of Repetition on Vocabulary Knowledge," *Applied Linguistics* 28, no. 1 (2007): 60; Rob Waring and Misako Takaki, "At What Rate do Learners Learn and Retain New Vocabulary from Reading a Graded Reader?," *Reading in a Foreign Language* 15, no. 2 (2003): 150–51.

[307] Paradis, "Individual Differences in Child English Second Language Acquisition," 230. Paradis found that both quantity and quality of exposure are important factors in child L2 acquisition.

as measured by quantity and quality of verbal input, had a significant effect on learners' grammar comprehension.[308] Quality of classroom input is highly dependent upon teacher fluency, and teacher fluency in the language is an important factor in student L2 learning, especially grammar, though it can affect vocabulary development as well.[309]

Significant exposure to the language can occur not only in the classroom, but outside the classroom. Outside exposure to input has been found to be a notable factor in L2 acquisition.[310] Though outside exposure to the L2 does seem to play a significant role in L2 acquisition, not all types of exposure are equally beneficial. A study by Muñoz and colleagues of elementary-aged L2 learners found that while audiovisual material was a significant factor in L2 acquisition, especially receptive grammar, playing videogames and listening to music did not affect L2 acquisition.[311] Just as in classroom input, both the quantity and quality of outside exposure makes a difference in L2 acquisition.

While various internal and external factors correlate with L2 acquisition in any population, such as those discussed above, three learner internal factors are particular of interest for the purposes of this study due to their atypical development in individuals with DS: NVC, VSTM, and L1 vocabulary. NVC has been found to correlate with L2 development in the TD population, and may be especially important in the beginning

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[308] Kristin Kersten et al., "Quality of L2 Input and Cognitive Skills Predict L2 Grammar Comprehension in Instructed SLA Independently," *Languages* 6, no. 3 (2021): 1–19.

[309] Graham et al., "Early Language Learning," 951; Sharon Unsworth et al., "An Investigation of Factors Affecting Early Foreign Language Learning in the Netherlands," *Applied Linguistics* 36, no. 5 (2015): 527–48; Kees deBot, "The Effectiveness of Early Foreign Language Learning in the Netherlands," *Studies in Second Language Learning and Teaching* 4, no. 3 (2014): 414.

[310] Sun et al., "Individual Differences," 560; Eva Lindgren and Carmen Muñoz, "The Influence of Exposure, Parents, and Linguistic Distance on Young European Learners' Foreign Language Comprehension," *International Journal of Multilingualism* 10, no. 1 (2013): 120–21; Muñoz, "Contrasting Effects of Starting Age," 14–15.

[311] Muñoz, Cadierno, and Casas, "Different Starting Points," 1076–109. Similar findings were found by Lindgren and Muñoz. Lindgren and Muñoz, "The Influence of Exposure," 122.

stages of L2 acquisition.[312] For example, Sun and colleagues found that NVC was a significant predictor of L2 receptive grammar.[313] While not as strong as grammar, NVC also influences L2 vocabulary development.[314] Though NVC does affect L2 development, it "may not be specific enough in what it measures to be predictive of children's language learning outcomes as reliably as a true language aptitude test."[315]

One key component of language aptitude is verbal memory.[316] VSTM, also known as phonological short-term memory (PSTM), is an individual's ability to recall spoken information.[317] VSTM seems to be a foundational component for FL acquisition, though its precise relationship to the various components of L2 learning is still under investigation.[318] Research clearly supports the notion that VSTM correlates with L2 vocabulary acquisition in TD populations in both the classroom context and naturalistic contexts.[319] More specifically, VSTM seems to play a "crucial role" in "the initial stages

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[312] Jaekel et al., "From Early Starters to Late Finishers?," 652.

[313] Sun et al., "Individual Differences," 560–61. See also Kersten et al., "Quality of L2 Input," 12.

[314] Heather Golberg, Johanne Paradis, and Martha Crago, "Lexical Acquisition over Time in Minority First Language Children Learning English as a Second Language," *Applied Psycholinguistics* 29, no. 1 (2008): 61. Paradis found that nonverbal IQ was a significant predictor of both vocabulary and verb morphology (grammar). Paradis, "Individual Differences in Child English Second Language Acquisition," 229.

[315] Golberg, Paradis, and Crago, "Lexical Acquisition over Time," 61.

[316] Paradis, "Individual Differences in Child English Second Language Acquisition," 214.

[317] Jarrold and Baddeley, "Short-Term Memory in Down Syndrome," 17.

[318] Lia Efstathiadi, "Early Foreign Language Learning: Intensive Exposure, Vocabulary Development and the Cognitive Skills Involved," *Belgrade English Language and Literature Studies* 11, no. 1 (2019): 96; Thomai Alexiou, "Young Learners' Cognitive Skills and their Role in Foreign Language Vocabulary Learning," in *Early Learning of Modern Foreign Languages: Processes and Outcomes*, ed. Marianne Nikolov (Bristol, UK: Multilingual Matters, 2009), 55–56. Of the five internal factors investigated, Paradis found that PSTM was the "strongest predictor for both vocabulary and verb morphology." Paradis, "Individual Differences in Child English Second Language Acquisition," 229.

[319] For VSTM and acquisition in the L2 classroom context, see Unsworth et al., "An Investigation of Factors," 543; Anne-Catherine Nicolay and Martine Poncelet, "Cognitive Abilities

of learning vocabulary in a new language," especially when that language is highly unfamiliar to the learner.[320] However, not all research supports this claim. Kormos and Sáfár found almost no relationship between PSTM as measured by nonword repetition taks and L2 skills in beginning language learners, while they found significant correlations between nonword repetition scores and composition task (composed of vocabulary and grammatical accuracy) in pre-intermediate learners. While this may seem contrary to the findings presented above, no direct measure of L2 vocabulary acquisition was conducted. Additionally, the majority of the L2 instruction received by the students was explicit grammar and vocabulary memorization and practice rather than more implicit methods.[321] Additionally, Efstathiadi found that while PSTM played a crucial role in L2 vocabulary acquisition, central executive working memory was a stronger predictor of comprehension and production than was PSTM in early stages of L2 acquisition.[322]

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underlying Second-Language Vocabulary Acquisition in an Early Second-Language Immersion Education Context: A Longitudinal Study," *Journal of Experimental Child Psychology* 115, no. 4 (2013): 664–67; Pascale M. J. Engel de Abreu and Susan E. Gathercole, "Executive and Phonological Processes in Second-Language Acquisition," *Journal of Educational Psychology* 104, no. 4 (2012): 981–82; Leif Michael French, *Phonological Working Memory and Second Language Acquisition: A Developmental Study of Francophone Children Learning English in Quebec* (Lewiston, NY: Edwin Mellen Press, 2006), 90–108, 113–16; and Elvira V. Masoura and Susan E. Gathercole, "Contrasting Contributions of Phonological Short-Term Memory and Long-Term Knowledge to Vocabulary Learning in a Foreign Language," *Memory* 13, no. 3–4 (2005): 422–29. For VSTM and acquisition in the naturalistic L2 context, see Josje Verhagen and Paul Leseman, "How do Verbal Short-Term Memory and Working Memory Relate to the Acquisition of Vocabulary and Grammar? A Comparison between First and Second Language Learners," *Journal of Experimental Child Psychology* 141 (2016): 65–82.

[320] Masoura and Gathercole, "Contrasting Contributions," 427. See also Engel de Abreu and Gathercole, "Executive and Phonological Processes," 982; French, *Phonological Working Memory*, 121–27; Elvira V. Masoura and Susan E. Gathercole, "Phonological Short-Term Memory and Foreign Language Learning," *International Journal of Psychology* 34, no. 5–6 (1999): 386; Elisabet Service and Viljo Kohonen, "Is the Relation between Phonological Memory and Foreign Language Learning Accounted for by Vocabulary Acquisition?," *Applied Psycholinguistics* 16, no. 2 (1995): 155–72.

[321] Judit Kormos and Anna Sáfár, "Phonological Short-Term Memory, Working Memory and Foreign Language Performance in Intensive Language Learning," *Bilingualism: Language and Cognition* 11, no. 2 (2008): 261–71.

[322] Efstathiadi, "Early Foreign Language Learning," 97.

While it seems evident that VSTM correlates with vocabulary development in L2 learners, its direct influence on grammar is less clear.[323] Several studies have found that VSTM predicts grammar development in the L2, especially as mediated by L2 vocabulary, though not all studies have demonstrated such robust links.[324] However, emerging evidence seems to indicate that VSTM correlates to L2 grammar, even when controlling for L2 vocabulary knowledge. This holds true in both instructed L2 learning and in a naturalistic L2 setting.[325]

Children with DS have deficits in VSTM, and these deficits seem to negatively affect their L1 development. Verhegan and Leseman found that "VSTM . . . (affects) L1 and L2 learning similarly" and suggest that this may "have implications for L2 children with poor verbal memory skills."[326] Thus, VSTM may thus serve as a useful predictor for FL vocabulary acquisition in children with DS. However, due to a lack of research among

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[323] Despite the robust evidence that VSTM supports L2 vocabulary, French and O'Brien found very little connection between phonological memory and L2 vocabulary development in a five-month intensive L2 learning program, with phonological memory exerting only a slight influence on productive vocabulary development and no influence on receptive vocabulary after controlling for initial vocabulary abilities. Leif M. French and Irena O'Brien, "Phonological Memory and Children's Second Language Grammar Learning," *Applied Psycholinguistics* 29, no. 3 (2008): 478. However, "there was a significant relationship between phonological memory and lexical knowledge on entry into the study" (476).

[324] For studies demonstrating that VSTM predicts L2 grammar development mediated by L2 vocabulary, see Verhagen and Leseman, "Verbal Short-term Memory and Working Memory," 65–82; French, *Phonological Working Memory*, 110–12, 128–30; Elisabet Service, "Phonology, Working Memory, and Foreign-Language Learning," *The Quarterly Journal of Experimental Psychology Section A* 45, no. 1 (1992): 21–50; Service and Kohonen, "Relation between Phonological Memory and Foreign Language Learning," 155–72. Paradis found a clear link between PSTM and verb morphology. However, vocabulary was not controlled for, therefore it is not possible to determine whether this effect was unmediated by L2 vocabulary. Paradis, "Individual Differences in Child English Second Language Acquisition," 229; Josje Verhagen, Paul Leseman, and Marielle Messer, "Phonological Memory and the Acquisition of Grammar in Child L2 Learners," *Language Learning* 65, no. 2 (2015): 420. Engel de Abreu and Gathercole found that PSTM was related to L2 grammar as mediated by L2 vocabulary. However, after controlling for SES an L1 vocabulary, this link no longer remained. Engel de Abreu and Gathercole, "Executive and Phonological Processes," 981–82.

[325] For instructed L2 learning see French and O'Brien, "Phonological Memory and Children's Second Language," 476–77. For a naturalistic L2 setting see Verhagen, Leseman, and Messer, "Phonological Memory and the Acquisition of Grammar," 440–41.

[326] Verhagen and Leseman, "Verbal Short-Term Memory and Working Memory," 79.

children with DS and populations with other memory impairments this claim has yet to be substantiated and would be an important topic for future research.[327]

The final factor of L2 acquisition of pertinence to this study is the relationship between L1 skills and L2 acquisition. Broadly speaking, L1 skills have been shown to correlate with L2 proficiency.[328] Sparks and colleagues found that measures of L1 skills in elementary school correlated with L2 aptitude in high school and suggest that "L1 skills may be an important source of individual differences among L2 learners."[329] In children with DLD, relationships between L1 and L2 seem to increase as the child increases in proficiency in both languages, and the relationship seem stronger for receptive skills. Additionally, relationships between L1 and L2 appear to be stronger in TD children than in children with DLD.[330]

L1 vocabulary may have a particular influence on L2 development. L1 vocabulary is positively linked to L2 listening comprehension, L2 phonological awareness, and L2 vocabulary acquisition.[331] Additionally, L1 vocabulary is especially

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[327] Verhagen and Leseman, "Verbal Short-Term Memory and Working Memory," 79.

[328] Richard L. Sparks, Jon Patton, and Julie Luebbers, "Individual Differences in L2 Achievement Mirror Individual Differences in L1 Skills and L2 Aptitude: Crosslinguistic Transfer of L1 to L2 Skills," *Foreign Language Annals* 52, no. 2 (2019): 255–83; Richard Sparks et al., "Long-Term Crosslinguistic Transfer of Skills from L1 to L2," *Language Learning* 59, no. 1 (2009): 203–43.

[329] Sparks et al., "Long-Term Crosslinguistic Transfer," 226–27.

[330] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14–15.

[331] For listening comprehension see Vandergrift and Baker, "Learner Variables in Second Language Listening," 407. For phonological awareness see Brenda K. Gorman, "Relationships between Vocabulary Size, Working Memory, and Phonological Awareness in Spanish-Speaking English Language Learners," *AJSLP* 21, no. 2 (2012): 117. For L2 vocabulary development see Vibeke Grøver, Joshua Lawrence, and Veslemøy Rydland, "Bilingual Preschool Children's Second-Language Vocabulary Development: The Role of First-Language Vocabulary Skills and Second-Language Talk Input," *International Journal of Bilingualism* 22, no. 2 (April 2018): 234–50, and Melissa Koenig and Amanda L. Woodward, "Toddlers Learn Words in a Foreign Language: The Role of Native Vocabulary Knowledge," *Journal of Child Language* 39, no. 2 (2012): 1–13.

important in developing L2 reading skills.[332] Though receptive vocabulary is a relative strength in individuals with DS, their L1 vocabulary levels are generally below that of their TD peers, thus L1 vocabulary, as well as their overall L1 language skills, could affect their L2 development.

Many factors, both internal and external, work together to affect L2 acquisition. Some of these factors, such as NVC and VSTM, may be especially salient in children with DS in the FL context. Much research is needed to investigate these topics.

Down Syndrome and Autism Spectrum Disorder

ASD is a neurodevelopmental disorder characterized by impairment in social communication and interaction and restricted and/or repetitive interests and behaviors.[333] The prevalence rate of ASD in individuals with DS far exceeds that of the general population, and thus and its impact on language development and development in individuals with DS is an important consideration.[334] This section will discuss L1 development in children with ASD, development in children with DS and a dual diagnosis of ASD, and bilingual language development in children with idiopathic ASD and a dual diagnosis of DS and ASD.

L1 Development in ASD

Though not a core symptom for diagnosis, language delay or impairment is a common symptom in young children with autism and is often a primary reason for which

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[332] Tong Li et al., "Longitudinal Predictors of Spelling and Reading Comprehension in Chinese as an L1 and English as an L2 in Hong Kong Chinese Children," *Journal of Educational Psychology* 104, no. 2 (2012): 295–99; C. Patrick Proctor et al., "The Intriguing Role of Spanish Language Vocabulary Knowledge in Predicting English Reading Comprehension," *Journal of Educational Psychology* 98, no. 1 (2006): 165–67.

[333] American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders: DSM-5*, 5th ed. (Arlington, VA: American Psychiatric Association, 2013), 53.

[334] For prevalence rates in DS population, see Seesahai et al., "Prevalence of Autism Spectrum Disorder," 1–20.

parents of children with ASD seek a clinical consultation, as well as a first cause for concern by parents.[335] Other significant symptoms in infants and toddlers which arouse parental concern are medical problems or delay in a milestone, motor difficulties, abnormal socio-emotional responses, restricted and repetitive behaviors, and nonspecific behavioral difficulties.[336] In the domain of communication and early precursors to spoken language, infants later diagnosed with ASD demonstrate "a delay or disorder in vocalizations and use of gestures . . . difficulty coordinating verbal and nonverbal behaviors," and impaired language comprehension.[337] Strongest pre-linguistic predictors

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[335] Maureen Aarons and Tessa Gittens, *The Handbook of Autism: A Guide for Parents and Professionals*, 2nd ed. (London: Routledge, 1999), 63; M. Franchini et al., "Variability in Verbal and Nonverbal Communication in Infants at Risk for Autism Spectrum Disorder: Predictors and Outcomes," *JADD* 48, no. 10 (2018): 3418. For cause of concern for parents, see Patrick F. Bolton et al., "Autism Spectrum Disorder and Autistic Traits in the Avon Longitudinal Study of Parents and Children: Precursors and Early Signs," *Journal of the American Academy of Child & Adolescent Psychiatry* 51, no. 3 (2012): 255; Andrea De Giacomo and Eric Fombonne, "Parental Recognition of Developmental Abnormalities in Autism," *European Child & Adolescent Psychiatry* 7, no. 3 (1998): 133–34; Megan Richards, Jana Mossey, and Diana L. Robins, "Parents' Concerns as They Relate to Their Child's Development and Later Diagnosis of Autism Spectrum Disorder," *Journal of Developmental & Behavioral Pediatrics* 37, no. 7 (2016): 6. For evidence of language delay, see Tony Charman et al., "Predicting Language Outcome in Infants with Autism and Pervasive Developmental Disorder," *IJLCD* 38, no. 3 (2003): 265–85; Tony Charman, et al., "Measuring Early Language Development in Preschool Children with Autism Spectrum Disorder Using the MacArthur Communicative Development Inventory (Infant Form)," *Journal of Child Language* 30, no. 1 (2003): 213–36; Joanne Volden et al., "Using the Preschool Language Scale, Fourth Edition to Characterize Language in Preschoolers with Autism Spectrum Disorders," *AJSLP* 20, no. 3 (2011): 200–208; Rose Nevill et al., "Language Profiles in Young Children with Autism Spectrum Disorder: A Community Sample Using Multiple Assessment Instruments," *Autism* 23, no. 1 (2019): 146; Joanne Gerenser and Karece Lopez, "Autism Spectrum Disorders," in *Handbook of Child Language Disorders*, 2nd ed., ed. Richard. G. Schwartz (New York: Routledge, 2017), 88.

[336] De Giacomo and Fombonne, "Parental Recognition of Developmental Abnormalities," 133–35; Richards, Mossey, and Robins, "Parents' Concerns," 6.

[337] Gerenser and Lopez, "Autism Spectrum Disorders," 86. For a more detailed list of prelinguistic communication behaviors, see Reah Paul and Donia Fahim, "Assessing Communication in Autism Spectrum Disorder," in *Handbook of Autism and Pervasive Developmental Disorders*, vol. 2, *Assessment, Interventions, and Policy*, 4th ed., ed. Fred R. Volkmar, Sally J. Rogers, Rhea Paul, and Kevin A. Pelphrey, (Indianapolis, IN: Wiley, 2014), 674. For evidence of delay/disorder in vocalization, see Elena Patten et al., "Vocal Patterns in Infants with Autism Spectrum Disorder: Canonical Babbling Status and Vocalization Frequency," *JADD* 44, no.10 (2014): 1–35; Sandra Maestro et al., "Attentional Skills during the First 6 Months of Age in Autism Spectrum Disorder," *Journal of the American Academy of Child & Adolescent Psychiatry* 41, no. 10 (2002): 1242. For evidence of delay/disorder in use of gestures, see Siobhan E. Colgan et al., "Analysis of Social Interaction Gestures in Infants with Autism," *Child Neuropsychology* 12, no. 4-5 (2006): 307–19; Shelley Mitchell et al., "Early Language and Communication

of language development in infants and preschoolers with ASD are joint attention, motor imitation and skills, participation in games and routines, and rate of communicative acts.[338]

Language regression is common in young children with autism, with as much as one quarter of the population experiencing language regression between the ages of twelve to eighteen months. Such regression often occurs in tandem with social-communication regression, and social-communication regression may also occur apart from language loss.[339] Language regression generally occurs in children with autism who

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Development of Infants Later Diagnosed with Autism Spectrum Disorder," *Journal of Developmental & Behavioral Pediatrics* 27, no. 2 (2006): S69–S78; Franchini et al., "Variability in Verbal and Nonverbal Communication," 3417–31. For evidence of difficulty coordinating verbal and nonverbal behaviors in infants, see Paul Yoder et al., "Predicting Social Impairment and ASD Diagnosis in Younger Siblings of Children with Autism Spectrum Disorder," *JADD* 39 (2009): 1–21, and Meaghan V. Parladé and Jana M. Iverson, "The Development of Coordinated Communication in Infants at Heightened Risk for Autism Spectrum Disorder," *JADD* 45 (2015): 2218–34. In older children see Amy L. Hubbard et al., "Altered Integration of Speech and Gesture in Children with Autism Spectrum Disorders," *Brain and Behavior* 2, no. 5 (2012): 606–19. For impaired comprehension see Mitchell et al., "Early Language and Communication Development," S69–S78.

[338] Charman et al., "Predicting Language Outcome," 280; Peter Mundy, Marian Sigman, and Connie Kasari, "A Longitudinal Study of Joint Attention and Language Development in Autistic Children," *JADD* 20, no. 1 (1990): 115–28; Sigman and Ruskin, "Continuity and Change," 47; Wendy L. Stone, Opal Y. Ousley, and Cynthia D. Littleford, "Motor Imitation in Young Children with Autism: What's the Object?," *Journal of Abnormal Child Psychology* 25 (1997): 481–85; Wendy L. Stone and Paul J. Yoder, "Predicting Spoken Language Level in Children with Autism Spectrum Disorders," *Autism* 5, no. 4 (2001): 341–61; Stacy Shumway and Amy M. Wetherby, "Communicative Acts of Children with Autism Spectrum Disorders in the Second Year of Life," *Journal of Speech and Language Research* 52, no. 5 (2009): 1–27; Karen D. Bopp and Pat Mirenda, "Prelinguistic Predictors of Language Development in Children with Autism Spectrum Disorders over Four–Five Years," *Journal of Child Language* 38, no. 3 (2011): 485–503; Veronica Smith, Pat Mirenda, and Anat Zaidman-Zait, "Predictors of Expressive Vocabulary Growth in Children with Autism," *JSLHR*, 50, no. 1 (2007): 149–60; Hayley C. Leonard et al., "Predicting the Rate of Language Development from Early Motor Skills in At-Risk Infants Who Develop Autism Spectrum Disorder," *Research in Autism Spectrum Disorders* 13–14 (2015): 1–19; Tager-Flusberg and Caronna note that "impairment in joint attention may be a primary deficit that leads to delays in language." Helen Tager-Flusberg and Elizabeth Caronna, "Language Disorders: Autism and Other Pervasive Developmental Disorders," *Pediatric Clinics of North America* 54, no. 3 (2007): 474.

[339] Tager-Flusberg and Caronna, "Language Disorders," 473. For examples of word loss and social regression, see Rhiannon Luyster et al., "Early Regression in Social Communication in Autism Spectrum Disorders: A Cpea Study," *Developmental Neuropsychology* 27, no. 3 (2005): 311–36 and Catherine Lord, Cory Shulman, and Pamela DiLavore, "Regression and Word Loss in Autistic Spectrum Disorders," *Journal of Child Psychology and Psychiatry* 45, no. 5 (2004): 936–55.

are only speaking in one-word utterances, and upon regression cease to use those words, or may have repeated word losses at an early age.[340] While present in only a minority of children with autism, word loss may serve as an important indicator of ASD, as it appears to be a unique, though not universal, characteristic of toddlers with ASD.[341]

In school-aged children NVC may be the strongest factor in language ability, followed by social competence.[342] Additionally, for children with intellectual disability, symbol understanding and joint attention are significant factors in language abilities.[343] While both receptive and expressive abilities may be delayed in children with ASD, an atypical pattern is often found in which receptive skills seem to be impacted (delayed) more severely relative to expressive skills, such that children with ASD do not understand as many words as TD children given the number of words they produce.[344]

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[340] Luyster et al., "Early Regression," 314. For description of repeated word loss, see Lord, Shulman, and DiLavore, "Regression and Word Loss," 939.

[341] Lord, Shulman, and DiLavore, "Regression and Word Loss," 946.

[342] Ericka L. Wodka, Pamela Mathy, and Luther Kalb, "Predictors of Phrase and Fluent Speech in Children with Autism and Severe Language Delay," *Pediatrics* 131, no. 4 (2013): e1128–34; Nevill et al., "Language Profiles in Young Children," 150. La Valle and colleagues found that verbally fluent individuals with ASD (ranging from ages six to twenty-one) had significantly higher NVIQ and receptive language skills than did minimally verbal individuals. Chelsea La Valle, Daniela Plesa-Skwerer, and Helen Tager-Flusberg, "Comparing the Pragmatic Speech Profiles of Minimally Verbal and Verbally Fluent Individuals with Autism Spectrum Disorder," *JADD* 50 (2020): 11. See also Margaret M. Kjelgaard and Helen Tager-Flusberg, "An Investigation of Language Impairment in Autism: Implications for Genetic Subgroups," *Language and Cognitive Processes* 16, no. 2-3 (2001): 6 for the relationship with IQ and language skills. However, it is important to note that IQ is not the only factor in language abilities. Kjelgaard and Tager-Flusberg found that some children with low IQ scores had language skills within the normal range, and conversely, some children with a normal IQ had impaired language skills. Kjelgaard and Tager-Flusberg, "An Investigation of Language Impairment," 8. In a novel word learning and retention task, Joseph and colleagues found that nonverbal IQ was a key factor in the ability to map the referent onto the novel object and social-affective skills a significant factor in retaining the word. Robert M. Joseph et al., "An Experimental Study of Word Learning in Minimally Verbal Children and Adolescents with Autism Spectrum Disorder," *Autism & Developmental Language Impairments* 4 (2019): 10.

[343] Jarymke Maljaars et al., "Language in Low-Functioning Children with Autistic Disorder: Differences between Receptive and Expressive Skills and Concurrent Predictors of Language," *JADD* 42, no. 10 (2012): 2187.

[344] Charman et al., "Measuring Early Language Development," 230; Charman et al., "Predicting Language Outcome," 265–85; Kristelle Hudry et al., "Preschoolers with Autism Show Greater

However, this gap between expressive and receptive skills may level out as nonverbal mental age (NVMA) increases.[345] Articulation at the word level seems to be relatively preserved in children with autism.[346]

Language ability may be particularly difficult to measure in children with autism not only because of age, but due to their lack of desire to use language, inability to understand the demands of a standardized assessment, or delay in their ability to show their competence.[347] Overall, the language abilities of children with ASD vary widely.

Impairment in Receptive Compared with Expressive Language Abilities," *IJLCD* 45, no. 6 (2010): 681–90. However, see Kjelgaard and Tager-Flusberg, "An Investigation of Language Impairment," 5–6, 8 for varying results which demonstrate comparable receptive and expressive skills, or at the very least that there was "no clear profile that characterized the children with autism in (their) study" (6). Nevill and colleagues note that the relationship between receptive and expressive language skills may depend in part on the instrument used as well as nonverbal development. Nevill et al., "Language Profiles in Young Children," 149. Pickles and colleagues found that expressive skills tended to exceed receptive as language competence increased. Andrew Pickles, Deborah K. Anderson, and Catherine Lord, "Heterogeneity and Plasticity in the Development of Language: A 17-Year Follow-up of Children Referred Early for Possible Autism," *Journal of Child Psychology and Psychiatry* 55, no. 12 (2014): 1360.

[345] Volden et al., "Using the Preschool Language Scale," 205; Nevill et al., "Language Profiles in Young Children," 147. Maljaars and colleagues examined the language abilities of children with ASD and intellectual disabilities and found that as a group they demonstrated higher expressive skills relative to receptive. Maljaars et al., "Language in Low-Functioning Children," 2181–91. For differing results, see Hudry et al., "Preschoolers with Autism," 681–90. Hudry and colleagues found that those children with a higher nonverbal age equivalent were more likely to exhibit the atypical pattern of comprehension lagging relative to production. They attribute this in part to the possibility that those participants with a lower non-verbal ability also displayed more severe autism symptoms and conclude that "low-functioning children with autism often have very limited language skills, and at low levels of raw comprehension there is little room for variability in raw production" (687). Similarly, Kjelgaard and Tager-Flusberg found that when measures by the *Peabody Picture Vocabulary Test*-III and *Expressive Vocabulary Test*, children did not show a discrepancy between receptive and expressive scores. However, those children who took the *Clinical Evaluation of Language Fundamentals* instead of the *PPVT-III* and *EVT* had a higher NVMA than those who did not and demonstrated higher expressive than receptive abilities. Kjelgaard and Tager-Flusberg, "An Investigation of Language Impairment," 5–6.

[346] Kjelgaard and Tager-Flusberg, "An Investigation of Language Impairment," 6–7. The key word here may be *relatively*, as some, such as Gerenser and Lopez and Rapin and Dunn argue that articulation and phonological skills are not as intact as Kjelgaard and Tager-Flusberg contend. Gerenser and Lopez, "Autism Spectrum Disorders," 90; Isabelle Rapin and Michelle Dunn, "Update on the Language Disorders of Individuals on the Autistic Spectrum," *Brain and Development* 25, no. 3 (2003): 166–72. For further evidence of articulation impairment, see Joanne Cleland et al., "Phonetic and Phonological Errors in Children with High Functioning Autism and Asperger Syndrome," *International Journal of Speech-Language Pathology* 12, no. 1 (2010): 69–76.

[347] Charman, et al., "Measuring Early Language Development," 215; Kjelgaard and Tager-

While many children with ASD display delayed language development and some never attain functional levels of language, others fall within typically developing norms in the structural categories of lexical and syntactic language and phonology.[348] Kjelgaard and Tager-Flusberg suggest that there is not one language phenotype for ASD, but rather at least two: one in which language skills are relatively normal and one in which language impairments are comparable to those found in individuals with specific language impairment, namely poorer performance on grammatical measures than vocabulary, and difficulty in a non-word repetition task, even if articulation skills are intact.[349] It may be the case that the language profile of preschool-aged children with ASD reflects that of children with SLI, while this trend decreases as children with ASD reach school age, with pragmatic difficulties increasing in relation to structural deficits.[350] However, Kjelgaard

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Flusberg, "An Investigation of Language Impairment," 9; Hudry et al., "Preschoolers with Autism," 687; Tager-Flusberg and Caronna, "Language Disorders," 472. Aarons and Gittens note that "delays in language acquisition may or may not indicate a fundamental language disorder." Rather, since "motivation to communicate is impaired . . . this will be a contributing factor to the delay in its acquisition." Aarons and Gittens, *The Handbook of Autism*, 63. Paul and Fahim offer helpful suggestions to help overcome difficulties in assessing the language skills of children with autism. Paul and Fahim, "Assessing Communication," 679.

[348] Helen Tager-Flusberg, "Strategies for Conducting Research on Language in Autism," *JADD* 34, no. 1 (2004): 76; Pickles, Anderson, and Lord, "Heterogeneity and Plasticity," 1354–62; Kjelgaard and Helen Tager-Flusberg, "An Investigation of Language Impairment," 1–21; Charman, et al., "Measuring Early Language Development," 230–31; Hudry et al., "Preschoolers with Autism," 685–87.

[349] Kjelgaard and Helen Tager-Flusberg, "An Investigation of Language Impairment," 1–21. See also Helen Tager-Flusberg, "Do Autism and Specific Language Impairment Represent Overlapping Language Disorders?," in *Developmental Language Disorders: From Phenotypes to Etiologies*, ed. Mabel Rice and Steven F. Warren (New York: Psychology Press, 2014) 31–52; Tager-Flusberg, "Strategies for Conducting Research," 77–78; Rapin and Dunn, "Update on the Language Disorders," 171. For divergent views see Nick G. Riches et al., "Sentence Repetition in Adolescents with Specific Language Impairments and Autism: An Investigation of Complex Syntax," *IJLCD* 45, no. 1 (2010): 47–60 and Lauren J. Taylor et al., "Evidence for Distinct Cognitive Profiles in Autism Spectrum Disorders and Specific Language Impairment," *JADD* 44 (2014): 19–30. Rapin and colleagues suggest that there are two types of language disorders among children with ASD: those with severe and persistent phonological impairment, and those with borderline/low average to better than average expressive phonology. Isabelle Rapin et al., "Subtypes of Language Disorders in School-Age Children with Autism," *Developmental Neuropsychology* 34, no. 1 (2009): 66–84. See also Rapin and Dunn, "Update on the Language Disorders," 171.

[350] See, for example, Hilde M. Geurts and Mariëtte Embrechts, "Language Profiles in ASD, SLI, and ADHD," *JADD* 38 (2008): 1931–43; Jill Boucher, "Research Review: Structural Language in

and Tager-Flusberg did not find any effect for age on the SLI-like profile in their study.[351]

While those children who score within typically developing norms may have a seemingly intact structural system, it is not flexible, and thus, they likely will have difficulty using that language properly in social situations, indicating a pragmatic impairment, a "hallmark" of autism.[352] Pragmatic deficits seem to affect individuals with ASD "regardless of language level," whether minimally verbal or verbally fluent.[353] Aarons and Gettens emphasize the pragmatic deficits in individuals with ASD and state that "social difficulties underlie the problems with language."[354] While individuals with autism typically experience impairments in all domains of social-pragmatic language use, impairments in "the use and understanding of affective expressions; prosody; overuse of rote, learned phrases; social responsiveness; and empathy and social relatedness with others," as well "quality of initiations with others, use and understanding of abstract language concepts like humor, and in overall quality and variety of interests" are especially pronounced.[355] As pragmatic use of language is necessary for social skills,

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Autistic Spectrum Disorder–Characteristics and Causes," *Journal of Child Psychology and Psychiatry* 53, no. 3 (2012): 219–33; Rapin et al., "Subtypes of Language Disorders," 66–84. It is important to note that Geurts and Embrechts utilized a parental checklist as opposed to actual language measurements in their study.

[351] Kjelgaard and Helen Tager-Flusberg, "An Investigation of Language Impairment," 6–9.

[352] Rebecca Landa, "Social Language Use in Asperger Syndrome and High-Functioning Autism," in *Asperger Syndrome*, ed. Ami Klin, Fred R. Volkmar, and Sara S. Sparrow (New York: Guilford Press, 2000), 125, 127, 142–43; Joanne Volden et al., "Brief Report: Pragmatic Language in Autism Spectrum Disorder: Relationships to Measures of Ability and Disability," *JADD* 39 (2009): 388; Volden et al., "Using the Preschool Language Scale," 200.

[353] La Valle, Plesa-Skwerer, and Tager-Flusberg, "Comparing the Pragmatic Speech Profiles," 12.

[354] Aarons and Gittens, *The Handbook of Autism*, 24.

[355] Amy Philofsky, Deborah J. Fidler, and Susan Hepburn, "Pragmatic Language Profiles of School-Age Children with Autism Spectrum Disorders and Williams Syndrome," *AJSLP* 16 no. 4 (2007): 13. See also Jessica Klusek, Gary E. Martin, and Molly Losh, "A Comparison of Pragmatic Language in

such impairments may cause difficulties in establishing and maintaining friendships, work place relationships, and societal functioning in general, and could "potentially (impact) other developmental domains" as well, including language development.[356]

While structural language skills (lexical, morphosyntactic, and semantic) and fluency seem to increase with developmental age, such that children with a higher NVMA have higher language skills, cognition seems to have a much lesser direct impact on pragmatic abilities.[357] However, structural language skills are a significant factor in pragmatic abilities in individuals with ASD. Volden and colleagues found that together with cognition (which seems to directly affect pragmatic abilities only slightly) structural language accounted for 70 percent variance in pragmatic abilities in a group of relatively high-functioning children with ASD.[358] The remaining 30 percent of variance not accounted for by cognition and structural language abilities seems to indicate the uniqueness of pragmatic impairment on the communicative abilities of individuals with ASD.[359] However, the difference may be dependent upon the type of measurement used.

Boys with Autism and Fragile X Syndrome," *JSLHR* 57, no. 5 (2014): 1692–707.

[356] Klusek, Martin, and Losh, "A Comparison of Pragmatic Language," 1692. See also Elisabeth M. Whyte and Keith E. Nelson, "Trajectories of Pragmatic and Nonliteral Language Development in Children with Autism Spectrum Disorders," *JOCD* 54 (2015): 7; Philosfsky, Fidler, and Hepburn, "Pragmatic Language Profiles," 13; La Valle, Plesa-Skwerer, and Tager-Flusberg, "Comparing the Pragmatic Speech Profiles," 3; Joseph et al., "An Experimental Study of Word Learning," 10; Gerenser and Lopez, "Autism Spectrum Disorders," 93; Tager-Flusberg and Caronna, "Language Disorders," 476.

[357] Volden and colleagues found that NVMA accounted for 73 percent of the variance in language scores in a group of preschoolers with ASD. Volden et al., "Using the Preschool Language Scale," 203. For school-aged children see Wodka, Mathy, and Kalb, "Predictors of Phrase and Fluent Speech," e1128–34.

[358] Reindal and colleagues found similar, though less robust results, with structural language accounting for 35.9 percent of variance in pragmatic scores, with little contribution by NVC. Lise Reindal et al., "Structural and Pragmatic Language Impairments in Children Evaluated for Autism Spectrum Disorder (ASD)," *JADD* (2021): 6–7.

[359] Volden et al., "Brief Report," 391; Reindal et al., "Structural and Pragmatic Language Impairments," 10. However, Whyte and Nelson argue that pragmatic language difficulties in children with ASD are not particular to ASD but rather are a result of basic language difficulties. Whyte and Nelson, "Trajectories of Pragmatic and Nonliteral Language Development," 12.

Klusek and colleagues found that when using a semi-naturalistic measurement of pragmatic abilities, severity of autism diagnosis accounted for 35 percent of variance in pragmatic skills, while when utilizing a standardized measurement, NVMA and language skills (receptive and expressive vocabulary and mean length of utterance at the morpheme level) accounted for 70 percent of variance, while severity of diagnosis did not impact pragmatic skills.[360]

Other atypical features of language in individuals with autism include echolalia (immediate or delayed repetition of words or phrases that someone else has said, using similar intonation), the impaired use of deictic terms (those terms which code a shifting reference between interlocutors), particularly the deviant use of pronouns, neologisms, and impaired use and comprehension of prosody.[361] Many children with autism may

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[360] Klusek, Martin, and Losh, "A Comparison of Pragmatic Language," 1699.

[361] So Hyun Kim et al., "Language and Communication in Autism," in *Handbook of Autism and Pervasive Developmental Disorders*, vol. 1, *Diagnosis Development, and Brain Mechanisms*, 4th ed, ed. Fred R. Volkmar, Sally J. Rogers, Rhea Paul, and Kevin A. Pelphrey (Indianapolis, IN: Wiley, 2014), 242–45; Paul and Fahim, "Assessing Communication," 680. For echolalia see Jacqueline M.A. Roberts, "Echolalia and Language Development in Children with Autism," in *Communication in Autism*, Trends in Language Acquisition Research, ed. Joanne Arciuli and Jon Brock (Amsterdam: John Benjamins, 2014), 55–74; La Valle, Plesa-Skwerer, and Tager-Flusberg, "Comparing the Pragmatic Speech Profiles," 1–28. For deictic terms see R. Peter Hobson, Rosa M. García-Pérez, and Anthony Lee, "Person-Centred (Deictic) Expressions and Autism," *JADD* 40, no. 4 (2010): 1–13; R. Peter Hobson, Anthony Lee, and Jessica A. Hobson, "Personal Pronouns and Communicative Engagement in Autism," *JADD* 40, no. 6 (2010): 653–64; Anthony Lee, R. Peter Hobson, and Shulamuth Chiat, "I, You, Me, and Autism: An Experimental Study," *JADD* 24, no. 2 (1994): 155–76. Naigles and colleagues note that although pronoun reversals are more prevalent in children with autism than TD children, this phenomenon should not be referred to as 'common' among children with autism and is likely largely echolalic. Letitia R. Naigles et al., "'You're Telling Me!' The Prevalence and Predictors of Pronoun Reversals in Children with Autism Spectrum Disorders and Typical Development," *Research in Autism Spectrum Disorders* 27 (2016): 17. For neologisms see J. Volden and C. Lord, "Neologisms and Idiosyncratic Language in Autistic Speakers," *JADD* 21, no. 2 (1991): 109–30. For prosody see Joshua John Diehl and Rhea Paul, "Acoustic Differences in the Imitation of Prosodic Patterns in Children with Autism Spectrum Disorders," *Research in Autism Spectrum Disorders* 6, no. 1 (2012): 1–23; Susan Peppé et al., "Expressive Prosody in Children with Autism Spectrum Conditions," *Journal of Neurolinguistics* 24, no. 1 (2011): 41–53; Joanne McCann et al., "Prosody and Its Relationship to Language in School-Aged Children with High-Functioning Autism," *IJLCD* 42, no. 6 (2007): 682–702; Joanne McCann and Sue Peppé, "Prosody in Autism Spectrum Disorders: A Critical Review," *IJLCD* 38, no. 4 (2003): 325–50.

never reach fluent use of language, and somewhere between 14 and 20 percent of children with autism will remain nonverbal by the age of nine.[362]

Development in Dual Diagnosis

The prevalence of ASD in individuals with DS far exceeds that of the general population, with some estimates as high as twenty-five times higher in the DS population.[363] The latest prevalence data from the United States demonstrates that one in thirty-six, or approximately 2.8 percent of eight-year old children from the general population have a diagnosis of ASD, whereas prevalence in the DS population varies from approximately 13 to 41 percent.[364] While a large portion of individuals with DS

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[362] Catherine Lord, Susan Risi, and Andrew Pickles, "Trajectory of Language Development in Autistic Spectrum Disorders," in *Developmental Language Disorders: From Phenotypes to Etiologies*, ed. Mabel Rice and Steven F. Warren (New York: Psychology Press, 2014), 19. Nonverbal is here used to mean not using five or more words on a daily basis. While 50 percent is a widely cited statistic for the prevalence of nonverbal children in the autism population, Lord and colleagues demonstrate that this statistic is outdated and currently inaccurate. The definition of nonverbal in studies in individuals with ASD is widely variable which may also account for some variation in reports. See Lord, Risi, and Pickles, "Trajectory of Language Development," 16–20.

[363] Capone et al., "Down Syndrome and Comorbid Autism-Spectrum Disorder," 373; Carolyn DiGuiseppi, et al., "Screening for Autism Spectrum Disorders in Children with Down Syndrome: Population Prevalence and Screening Test Characteristics," *Journal of Developmental & Behavioral Pediatrics* 31, no. 3 (2010): 9.

[364] For prevalence in the general population, see Matthew J. Maenner et al., "Prevalence and Characteristics of Autism Spectrum Disorder among Children Aged 8 Years—Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2020," *Morbidity and Mortality Weekly Report Surveillance Summaries* 72, no. 2 (2023): 1–14. For prevalence of ASD in the DS population, see DiGuiseppi, et al., "Screening for Autism Spectrum Disorders," 9, 20 (prevalence of 18 percent); Capone et al., "Down Syndrome and Comorbid Autism," 377 (prevalence of 12.9 percent); Ulrika Wester Oxelgren et al., "Prevalence of Autism and Attention-Deficit–Hyperactivity Disorder in Down Syndrome: A Population-Based Study," *Developmental Medicine & Child Neurology* 59, no. 3 (2017): 276–83 (prevalence of 41 percent); Susan Hepburn et al., "Autism Symptoms in Toddlers with Down Syndrome: A Descriptive Study," *Journal of Applied Research in Intellectual Disabilities* 21, no. 1 (2008): 1–15 (prevalence of 15 percent); Georgina Warner et al., "Autism Characteristics and Behavioural Disturbances in~ 500 Children with Down's Syndrome in England and Wales," *Autism* Research 7, no. 4 (2014): 433–41 (prevalence of 37.7 percent); Rosane Lowenthal et al., "Prevalence of Pervasive Developmental Disorder in Down's Syndrome," *JADD* 37 (2007): 1394–95 (prevalence of 15.6 percent); Jo Moss et al., "Prevalence of Autism Spectrum Disorder Symptomatology and Related Behavioural Characteristics in Individuals with Down Syndrome," *Autism: The International Journal of Research & Practice* 17, no. 4 (2013): 396 (prevalence of 19 percent). The vast difference in prevalence rates in studies is due in part to a lack of validated tools for the DS population and lack of consensus in diagnostic methodology, among other

may meet diagnostic criteria for a diagnosis of ASD, this diagnosis usually occurs later in childhood than children without DS due to the difficulty of diagnosis.[365] Whereas the average age for diagnosis of ASD in the general population is approximately four to five years old, children with DS do not receive a diagnosis of ASD on average until they are eleven and a half years old.[366] This delay in diagnosis is due in part to the overlap of symptoms in DS and ASD, such as communication difficulties, cognitive impairments, motor difficulties, executive functioning impairments, and social deficits.[367] Children

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factors, but the identification of ASD has increased in recent years. For example, older studies cite prevalence rates between 2 to 7 percent. Collacott, Cooper, and McGrother, "Differential Rates of Psychiatric Disorders," 671–74 (prevalence of 2 percent); Mohammad Ghaziuddin, Luke Y. Tsai, and Neera Ghaziuddin, "Autism in Down's Syndrome: Presentation and Diagnosis," *JIDR* 36, no. 5 (1992): 454 (prevalence of 4 to 5 percent); Kent et al., "Comorbidity of Autistic Spectrum Disorders," 156 (prevalence of 7 percent). Such an increase may reflect in part the increased rate of identification in the general population. Seesahai et al., "Prevalence of Autism Spectrum Disorder," 3–5; K. Kroeger and Nelson, "A Language Programme," 102.

[365] Rasmussen et al., "Autistic Disorders," 751; Colin Reilly, "Autism Spectrum Disorders in Down Syndrome: A Review," *Research in Autism Spectrum Disorders* 3, no. 4 (2009): 830; P. Howlin, L. Wing, and J. Gould, "The Recognition of Autism in Children with Down Syndrome-Implications for Intervention and Some Speculations about Pathology," *Developmental Medicine & Child Neurology* 37, no. 5 (1995): 412–13.

[366] It is important to note that for both populations, age of diagnosis varies widely and depends upon a large number of factors. For age of diagnosis in the general population, see Maenner et al., "Prevalence and Characteristics," 6; Geraldine Leader et al., "Age of Autism Spectrum Disorder Diagnosis and Comorbidity in Children and Adolescents with Autism Spectrum Disorder," *Developmental Neurorehabilitation* 25, no. 1 (2022): 32; Christina G. McDonnell et al., "Sex Differences in Age of Diagnosis and First Concern among Children with Autism Spectrum Disorder," *Journal of Clinical Child & Adolescent Psychology* 50, no. 5 (2021): 648; Katharine Elizabeth Zuckerman, Olivia Jasmine Lindly, and Brianna Kathleen Sinche, "Parental Concerns, Provider Response, and Timeliness of Autism Spectrum Disorder Diagnosis," *Journal of Pediatrics* 166, no. 6 (2015): 7; Maria Valicenti-McDermott et al., "Age at Diagnosis of Autism Spectrum Disorders," *Journal of Pediatrics* 161, no. 3 (2012): 555; Christine Fountain, Marissa D. King, and Peter S. Bearman, "Age of Diagnosis for Autism: Individual and Community Factors across 10 Birth Cohorts," *Journal of Epidemiology & Community Health* 65, no. 6 (2011): 13–14; David S. Mandell et al., "Age of Diagnosis among Medicaid-Enrolled Children with Autism, 2001–2004," *Psychiatric Services* 61, no. 8 (2010): 825; Susan Siklos and Kimberly A. Kerns, "Assessing the Diagnostic Experiences of a Small Sample of Parents of Children with Autism Spectrum Disorders," *RDD* 28, no. 1 (2007): 17–18; Patricia Howlin and Anna Asgharian, "The Diagnosis of Autism and Asperger Syndrome: Findings from a Survey of 770 Families," *Developmental Medicine and Child Neurology* 41, no. 12 (1999): 836. For age of diagnosis in DS, see Rasmussen et al., "Autistic Disorders in Down Syndrome," 751; Noemi Alice Spinazzi et al., "Autism Spectrum Disorder in Down Syndrome: Experiences from Caregivers," *JADD* (2023): 3.

[367] Molloy et al., "Differences in the Clinical Presentation," 148; Marie Moore Channell et al.,

with a dual diagnosis differ in the presentation of autistic symptomology from children with ASD only; the presentation of these symptoms may be more subtle and thus more difficult for parents to recognize.[368] Efforts to accurately diagnose children with DS with ASD may be further confounded by varying methodologies of diagnosis, comprehensiveness of diagnostic protocols, and the tendency of some diagnostic tools to not sufficiently distinguish the effects of cognitive impairment from those of ASD.[369] Additionally, children with hearing problems, vision impairment, and premature birth are more likely to receive a false positive diagnosis of ASD.[370] As in the general population, the prevalence of ASD in children with DS is generally higher in males than in females.[371]

"Patterns of Autism Spectrum Symptomatology in Individuals with Down Syndrome without Comorbid Autism Spectrum Disorder," *Journal of Neurodevelopmental Disorders* 7, no. 1 (2015): 1–9; DiGuiseppi, et al., "Screening for Autism Spectrum Disorders," 11; Channell et al., "Characteristics Associated with Autism Spectrum Disorder," 3544.

[368] Mary Godfrey et al., "Autism Spectrum Disorder (ASD) Symptom Profiles of Children with Comorbid Down Syndrome (DS) and ASD: A Comparison with Children with DS-Only and ASD-Only," *RDD* 89 (2019): 91; Taralee Hamner et al., "Cognitive Profiles and Autism Symptoms in Comorbid Down Syndrome and Autism Spectrum Disorder," *Journal of Developmental & Behavioral Pediatrics* 41, no. 3 (2020): 177.

[369] DiGuiseppi, et al., "Screening for Autism Spectrum Disorders," 2–3, 10; Channell et al., "Patterns of Autism Spectrum Symptomatology," 6; Reilly, "Autism Spectrum Disorders," 836–37; Seesahai et al., "Prevalence of Autism Spectrum Disorder," 3–4. See C. Reilly, J. Senior, and L. Murtagh, "ASD, ADHD, Mental Health Conditions and Psychopharmacology in Neurogenetic Syndromes: Parent Survey," *JIDR* 59 no. 4 (2015): 307–18 for similar difficulties in diagnosing ASD in other neurogenetic symptoms, especially when cognitive impairment is present, what the authors refer to as "diagnostic overshadowing."

[370] DiGuiseppi, et al., "Screening for Autism Spectrum Disorders," 9.

[371] Reilly, "Autism Spectrum Disorders," 835–36; Capone et al., "Down Syndrome and Comorbid Autism," 373–75; T. Nærland et al., "Age and Gender-Related Differences in Emotional and Behavioural Problems and Autistic Features in Children and Adolescents with Down Syndrome: A Survey-Based Study of 674 Individuals," *JIDR* 61, no. 6 (June 2017): 598–99; Georgina Warner et al., "Autism Characteristics and Behavioural Disturbances in∼ 500 Children with Down's Syndrome in England and Wales," *Autism* Research 7, no. 4 (2014): 436; Carter et al., "Autistic-Spectrum Disorders," 88–89. However, for similar rates see Lowenthal et al., "Prevalence of Pervasive Developmental Disorder," 1394–95; Moss et al., "Prevalence of Autism Spectrum Disorder," 396.

Despite the later diagnosis of ASD for children with DS, reliable symptoms are likely to be present and identifiable as early as three years old, and severity of the symptoms may worsen with age.[372] When compared to children with DS only, children with DS and a comorbid diagnosis of ASD have significantly lower cognition, including verbal, non-verbal, and full-scale IQ.[373] While some children with DS without a diagnosis of ASD may have only a mild form of intellectual disability, children with a dual diagnosis tend to have moderate to severe intellectual disability.[374] Thus, severely impaired children with DS are significantly more likely to have a co-occurring diagnosis of ASD than those with mild cognitive impairment.[375] Additionally, the severity of social-communication impairment in children with a dual diagnosis is significantly related to verbal MA, such that as verbal MA decreases, social-communication impairment increases, whereas this relationship is not present in children with idiopathic ASD or DS only.[376]

Children with a comorbid diagnosis of DS and ASD tend to exhibit higher rates of restricted, repetitive, and stereotyped behavior, and poorer social interaction and nonverbal communication than their peers without ASD.[377] However, these impairments

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[372] Hepburn et al., "Autism Symptoms in Toddlers," 7; Howling, Wing, and Gould, "The Recognition of Autism," 407–9.

[373] Molloy et al., "Differences in the Clinical Presentation," 146–47; Oxelgren et al., "Prevalence of Autism," 279–80; Hamner et al., "Cognitive Profiles and Autism Symptoms," 175; Carter et al., "Autistic-Spectrum Disorders in Down Syndrome," 88–89.

[374] Molloy et al., "Differences in the Clinical Presentation," 147; Reilly, "Autism Spectrum Disorders," 835; Capone et al., "Down Syndrome and Comorbid Autism," 376; Dressler et al., "The Autistic Phenotype," 153.

[375] DiGuiseppi, et al., "Screening for Autism Spectrum Disorders," 11; Capone et al., "Down Syndrome and Comorbid Autism," 377; Nærland et al., "Age and Gender-Related Differences," 599.

[376] Godfrey et al., "Autism Spectrum Disorder (ASD) Symptom Profiles," 87–88; Nærland et al., "Age and Gender-Related Differences," 599.

[377] Molloy et al., "Differences in the Clinical Presentation," 147–48; Godfrey et al., "Autism Spectrum Disorder (ASD) Symptom Profiles," 83–93; Warner et al., "Autism Characteristics and

in social-communication and restricted and repetitive behaviors and interests are generally less severe than in children with ASD in the general population.[378] While some studies demonstrate that engagement in restricted and repetitive behaviors in children with a dual diagnosis may be less severe than their impairment in social skills and communication, other studies demonstrate comparable impairment among all domains.[379] Though lower cognition does contribute to increased autistic symptoms in children with a dual diagnosis, the presence of autistic symptoms goes above and beyond the influence of impaired cognition and are thus distinct from cognitive impairment.[380] While children

Behavioural Disturbances," 436–38; Moss et al., "Prevalence of Autism Spectrum Disorder," 390–404; Capone et al., "Down Syndrome and Comorbid Autism," 375–76; Hamner et al., "Cognitive Profiles and Autism Symptoms," 175–76; Alexandria Cook, Emily D. Quinn, and Charity Rowland, "Exploring Expressive Communication Skills in a Cross-Sectional Sample of Individuals with a Dual Diagnosis of Autism Spectrum Disorder and Down Syndrome," *American Journal on Intellectual and Developmental Disabilities* 126, no. 2 (2021): 97–113.

[378] Godfrey et al., "Autism Spectrum Disorder (ASD) Symptom Profiles," 83–93; Warner et al., "Autism Characteristics and Behavioural Disturbances," 433–41; Hamner et al., "Cognitive Profiles and Autism Symptoms," 175–76. However, Warner and colleagues found no significant differences between the ASD only and DS with ASD group in the restricted and repetitive behaviors and interests domain except for the compulsions and rituals item, for which the children with a dual diagnosis displayed greater impairment. Warner et al., "Autism Characteristics and Behavioural Disturbances," 437; Georgina Warner et al, "Profiles of Children with Down Syndrome Who Meet Screening Criteria for Autism Spectrum Disorder (ASD): A Comparison with Children Diagnosed with ASD Attending Specialist Schools," *JIDR* 61, Article in Press (2017): 9. Additionally, Moss and colleagues found that the participants in their study with a dual diagnosis presented the same profile of impairments as their idiopathic ASD controls matched for severity of autistic symptomology and adaptive behavior estimate. Moss et al., "Prevalence of Autism Spectrum Disorder," 390–404. When comparing individuals with ASD and comorbid intellectual disability, Bradbury and colleagues found that overall severity and impairment in social affect and restrictive and repetitive behaviors did not differ. Kathryn R. Bradbury et al., "Co-Occurring Down Syndrome and Autism Spectrum Disorder: Cognitive, Adaptive, and Behavioral Characteristics," *JADD* 52, no. 3 (2022): 1241.

[379] For lower impairment in repetitive behaviors, see Oxelgren et al., "Prevalence of Autism," 279; Molloy et al., "Differences in the Clinical Presentation," 147; Hepburn et al., "Autism Symptoms in Toddlers," 14. For similar level of impairment, see Godfrey et al., "Autism Spectrum Disorder (ASD) Symptom Profiles," 91; Nærland et al., "Age and Gender-Related Differences," 597; Hamner et al., "Cognitive Profiles and Autism Symptoms," 175–76.

[380] Molloy et al., "Differences in the Clinical Presentation," 147–49; Godfrey et al., "Autism Spectrum Disorder (ASD) Symptom Profiles," 91; Dressler et al., "The Autistic Phenotype," 153–55; Hamner et al., "Cognitive Profiles and Autism Symptoms," 176–77; Cook, Quinn, and Rowland, "Exploring Expressive Communication," 106; Moss et al., "Prevalence of Autism Spectrum Disorder," 400.

with DS with comorbid ASD do not generally differ from those without in terms of medical conditions, they may be more likely to have a history of seizures and an elevated family history of impaired social skills.[381]

Children with a dual diagnosis not only differ from their peers with DS only in terms of the presence and severity of autistic symptoms, but also in other behavioral characteristics. They tend to experience greater emotional difficulties, such as anxious behavior, as well as increased conduct problems, conflict with their peers, hyperactivity, and social withdrawal than children without ASD, as well as less prosocial behavior.[382] Irritability and lethargy are also more prominent in children with a dual diagnosis.[383] Additionally, children with a dual diagnosis may be more prone to self-injurious behavior than those without ASD.[384]

Children with a dual diagnosis tend to have lower language skills, both receptive and expressive, than their peers with DS only, and are less likely to achieve spoken or phrasal speech.[385] Those children with a dual diagnosis who are verbal are

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[381] For no difference in medical conditions, see Oxelgren et al., "Prevalence of Autism," 276–83; Anastasia Dressler et al., "The Autistic Phenotype in Down Syndrome: Differences in Adaptive Behaviour versus Down Syndrome Alone and Autistic Disorder Alone," *Functional Neurology* 26, no. 3 (2011): 153. For seizures see Molloy et al., "Differences in the Clinical Presentation," 148. For familial history of impaired social skills, see Reilly, "Autism Spectrum Disorders," 836; Lowenthal et al., "Prevalence of Pervasive Developmental Disorder," 1394–95. Rasmussen and colleagues suggest that certain hereditary factors, as well as prenatal, perinatal, and neonatal factors, malformations, epilepsy, and hypothyroidism may contribute to the presence of ASD in individuals with DS. However, these symptoms are not uncommon in individuals with DS, and no control group was used for comparison, thus any suggestions made as to their importance may only be taken as suggestive, at best. Rasmussen et al., "Autistic Disorders in Down Syndrome," 750–54.

[382] Warner et al., "Autism Characteristics and Behavioural Disturbances," 438; Carter et al., "Autistic-Spectrum Disorders in Down Syndrome," 87–94.

[383] Capone et al., "Down Syndrome and Comorbid Autism," 376.

[384] Moss et al., "Prevalence of Autism Spectrum Disorder," 397.

[385] Molloy et al., "Differences in the Clinical Presentation," 146–47; Warner et al., "Autism Characteristics and Behavioural Disturbances," 435–38; Cook, Quinn, and Rowland, "Exploring Expressive Communication," 97–113.

more likely to acquire speech at a much later age than those without comorbid ASD.[386] The language of children with a dual diagnosis is more likely to be repetitive or inappropriate and to not display true communicative intent than that of their peers with DS only.[387] Additionally, when verbal skills are lacking, children with a dual diagnosis are less likely to compensate with other forms of communication such as gestures.[388] Overall, individuals with DS only employ a greater amount of conventional gestures and signs, vocalizations, spoken words, and symbol combinations, than their peers with a dual diagnosis, and on average have nine to eighteen more ways to express their thoughts, desires, and feelings using these means.[389] Furthermore, children with a dual diagnosis are more likely to experience language loss, as well as the loss of other more general skills.[390] While language or skill loss is a common symptom of ASD, the regression experienced by children with a dual diagnosis occurs significantly later than in children with idiopathic ASD, as late as five years of age.[391] Overall, while the developmental profile of individuals with a dual diagnosis shares characteristics with their peers with DS only and idiopathic ASD, they differ from these peers in significant ways, resulting in a distinct developmental profile.

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386 Warner et al., "Autism Characteristics and Behavioural Disturbances," 438.

387 Capone et al., "Down Syndrome and Comorbid Autism," 376–77; Moss et al., "Prevalence of Autism Spectrum Disorder," 397.

388 Capone et al., "Down Syndrome and Comorbid Autism," 376. Lorang and colleagues found that as ASD symptoms increased in individuals with DS, use of gestures for communication decreased among children and adolescents with DS with phrasal speech. Emily Lorang, Audra Sterling, and Expressive Language Consortium, "The Impact of Autism Spectrum Disorder Symptoms on Gesture Use in Fragile X Syndrome and Down Syndrome," *Autism & Developmental Language Impairments* 2 (2017): 1–14.

389 Cook, Quinn, and Rowland, "Exploring Expressive Communication," 105.

390 Warner et al., "Autism Characteristics and Behavioural Disturbances," 438.

391 Heidi Castillo et al., "Difference in Age at Regression in Children with Autism with and without Down Syndrome," *Journal of Developmental & Behavioral Pediatrics* 29, no. 2 (2008): 89–93.

Bilingual Language Development in ASD and Dual Diagnosis

Research on bilingualism in individuals with ASD is still in its early stages. Semantics (vocabulary) is the most commonly researched domain of bilingual language development, with pragmatic and phonological skills least researched.[392] Additionally, only a narrow portion of the ASD population is generally included in research on multilingualism in ASD. Individuals with intellectual disabilities, complex communication needs, or exposure to more than two languages are generally excluded from such research.[393] Thus, any conclusions below may not be generalizable to the entire ASD population.

As with parents of children with DS, parents of children with ASD are often advised by professionals not to expose their child to more than one language.[394] For children whose family's home language is one other than that of the majority language,

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392 Christina Sophia Gilhuber, Tracy Jane Raulston, and Kasie Galley, "Language and Communication Skills in Multilingual Children on the Autism Spectrum: A Systematic Review," *Autism* 27, no. 6 (2023): 1525.

393 Gilhuber, Raulston, and Galley, "Language and Communication Skills," 1526; Heather Drysdale, Larah van der Meer, and Debora Kagohara, "Children with Autism Spectrum Disorder from Bilingual Families: A Systematic Review," *Review Journal of Autism and Developmental Disorders* 2, no. 1 (2015): 35; Michelle Wang et al., "Raising Children with Autism Spectrum Disorders in Monolingual vs Bilingual Homes: A Scoping Review," *Journal of Developmental & Behavioral Pediatrics* 39, no. 5 (2018): 444.

394 Myriam L. H. Beauchamp, Stefano Rezzonico, and Andrea A. N. MacLeod, "Bilingualism in School-Aged Children with ASD: A Pilot Study," *JADD* 50, no. 12 (2020): 4445; Elizabeth Kay-Raining Bird, Erin Lamond, and Jeanette Holden, "Survey of Bilingualism in Autism Spectrum Disorders," *IJLCD* 47, no. 1 (2012): 58–61; Tamar Kremer-Sadlik, "To Be or Not to Be Bilingual: Autistic Children from Multilingual Families," in *Proceedings of the 4th International Symposium on Bilingualism*, ed. James Cohen, Kara T. McAlister, Kellie Rolstad, and Jeff MacSwan (Somerville, MA: Cascadilla Press, 2005), 1225–27; Elizabeth Ijalba, "Hispanic Immigrant Mothers of Young Children with Autism Spectrum Disorders: How Do They Understand and Cope with Autism?," *AJSLP* 25, no. 2 (2016): 9–10; Betty Yu, "Bilingualism as Conceptualized and Bilingualism as Lived: A Critical Examination of the Monolingual Socialization of a Child with Autism in a Bilingual Family," *JADD* 46 (2016): 428–29; Brinda Jegatheesan, "Multilingual Development in Children with Autism: Perspectives of South Asian Muslim Immigrant Parents on Raising a Child with a Communicative Disorder in Multilingual Contexts," *Bilingual Research Journal* 34, no. 2 (2011): 185–200; Drysdale, van der Meer, and Kagohara, "Children with Autism Spectrum Disorder," 26–38; Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 5.

this can exacerbate the social difficulties of the child with ASD, as they may miss out on important relationships and opportunities to engage in meaningful conversation and social skills.[395] However, such advice is misguided as research demonstrates that bilingualism in children with ASD has no detrimental effect on language development, social skills, autism severity, or cognitive functioning.[396] Children with ASD are able to

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[395] Kremer-Sadlik, "To Be or Not to Be Bilingual," 1225–34; Gilhuber, Raulston, and Galley, "Language and Communication Skills," 1519; Myriam L. H. Beauchamp and Andrea A. N. MacLeod, "Bilingualism in Children with Autism Spectrum Disorder: Making Evidence Based Recommendations," *Canadian Psychology/Psychologie Canadienne* 58, no. 3 (2017): 254, 259; Carlin Conner, Doris L. Baker, and Jill H. Allor, "Multiple Language Exposure for Children with Autism Spectrum Disorder from Culturally and Linguistically Diverse Communities," *Bilingual Research Journal* 43, no. 3 (2020): 287–88.

[396] For a review see Wang et al., "Raising Children with Autism," 434–46. For impact on language, see Catherine Hambly and Eric Fombonne, "The Impact of Bilingual Environments on Language Development in Children with Autism Spectrum Disorders," *JADD* 42, no. 7 (2012): 1342–52; Beauchamp, Rezzonico, and MacLeod, "Bilingualism in School-Aged Children," 4443; Huong Hoang, Ana Maria Gonzalez-Barrero, and Aparna Nadig, "Narrative Skills of Bilingual Children with Autism Spectrum Disorder," *Discours. Revue de linguistique, psycholinguistique et informatique. A Journal of Linguistics, Psycholinguistics and Computational Linguistics* 23 (2018): 3–33; Natalia Meir and Rama Novogrodsky, "Prerequisites of Third-Person Pronoun Use in Monolingual and Bilingual Children with Autism and Typical Language Development," *Frontiers in Psychology* 10 (2019): 1–14; Natalia Meir and Rama Novogrodsky, "Syntactic Abilities and Verbal Memory in Monolingual and Bilingual Children with High Functioning Autism (HFA)," *First Language* 00, no. 0 (2019): 1–26; Meir Natalia and Rama Novogrodsky, "Referential Expressions in Monolingual and Bilingual Children with and without Autism Spectrum Disorder (ASD): A Study of Informativeness and Definiteness," *Journal of Child Language* 50, no. 2 (2023): 215–44. However, in a large population-based study, Chaidez and colleagues found that direct exposure to a second language 25 to 50 percent of the time was significantly associated with lower expressive and receptive language skills among two- to five-year-olds. This was true for both children with ASD and TD controls. Virginia Chaidez, Robin L. Hansen, and Irva Hertz-Picciotto, "Autism Spectrum Disorders in Hispanics and Non-Hispanics," *Autism* 16, no. 4 (2012): 7. See also Allison B. Ratto, Gabrielle Reimann, and Nicole Nadwodny, "Dual Language Learning Predicts Improved Executive Functioning in Youth with Autism," *JADD* 52 (2022): 5007–17 for lower verbal abilities in bilingual children and youth ages five to seventeen as compared to the monolingual peers. It is important to note, however, that both the Chaidez study and the Ratto study only measured language abilities in one language for bilingual participants, thus possibly not taking into account their full verbal abilities. For impact on social abilities, see Samantha Siyambalapitiya et al., "Longitudinal Social and Communication Outcomes in Children with Autism Raised in Bi/Multilingual Environments," *JADD* 52, no. 1 (2022): 339–48; Maria Valicenti-McDermott, Rosa Seijo, and Lisa Shulman, "Social Differences between Monolingual English and Bilingual English-Spanish Children with Autism Spectrum Disorders," *Pediatric Neurology* 100 (2019): 55–59; Sunitha Sendhilnathan and Shyamala K. Chengappa, "Cognitive, Social Communication and Social Skills Development in Monolingual and Bilingual Children with Autism Spectrum Disorders in a Multi Ethnic-Lingual Context–A Comparative Study," *Journal of Psychosocial Research* 15, no. 1 (2020): 47–68; Vanessa Zhou et al., "An Exploratory Longitudinal Study of Social and Language Outcomes in Children with Autism in Bilingual Home Environments," *Autism* 23, no. 2 (2019): 1–19. For impact on autism severity and/or cognitive functioning, see Valicenti-McDermott, Seijo, and Shulman,

become bilingual and develop on par with their monolingual peers with ASD and may even experience some cognitive and social benefits from bilingualism.[397]

Bilingual exposure does not seem to add an additional burden to the early language development of very young children with ASD and may even confer some communicative benefits.[398] Valicenti-McDermott found that bilingual toddlers with ASD exhibited more cooing and protoimperative gestures than their monolingual peers.[399] Ohashi and colleagues compared monolingually-and bilingually-exposed very young children with ASD, aged thirty-one to fifty-two months, matched on age and NVIQ, on six measurements of communication, including age of first words and phrases, and no significant differences were found on any of the measurements.[400] Similarly, using parental report measures, Hambly and Fombonne found that the onset of early-language milestones, expressive vocabularies, and receptive skills of young bilingually exposed children with ASD (ages thirty-six to seventy-eight months) in their dominant language did not differ significantly from those of monolingual children, and the timing of first exposure to a second language (before or after twelve months) did not significantly

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"Social Differences," 55–59; Maria Valicenti-McDermott et al., "Language Differences between Monolingual English and Bilingual English-Spanish Young Children with Autism Spectrum Disorders," *Journal of Child Neurology* 28, no. 7 (2013): 945–48; Sendhilnathan and Shyamala K. Chengappa, "Cognitive, Social Communication and Social Skills Development," 47–68; Vanegas, "Academic Skills," 5–6; Kay-Raining Bird, Lamond, and Holden, "Survey of Bilingualism," 52–64.

[397] Beauchamp and MacLeod, "Bilingualism in Children with Autism Spectrum Disorder," 256–58; Gilhuber, Raulston, and Galley, "Language and Communication Skills," 1525–27. For social benefits see Zhou et al., "An Exploratory Longitudinal Study," 10; Ingrid Hastedt et al., "Bilingual and Monolingual Autistic Toddlers: Language and Social Communication Skills," *JADD* 53, no. 6 (2023): 2185–202.

[398] J. Kaori Ohashi et al., "Comparing Early Language Development in Monolingual-and Bilingual-Exposed Young Children with Autism Spectrum Disorders," *Research in Autism Spectrum Disorders* 6, no. 2 (2012): 895.

[399] Valicenti-McDermott et al., "Language Differences," 945–48.

[400] Ohashi et al., "Comparing Early Language Development," 890–97.

impact language skills in the dominant language.[401] Numerous other studies make clear that bilingually exposed toddlers and pre-school aged children with ASD can achieve language levels commensurate to those of their monolingual peers with ASD, and bilingualism may even afford them linguistic benefits.[402] For example, Petersen and colleagues found that upon controlling for NVIQ, preschool-aged Chinese-English bilinguals with ASD had larger total productive vocabularies than their monolingual peers and equal conceptual and English vocabulary sizes.[403] Additionally, bilingually exposed children with ASD not only develop similar structural language abilities, but also maintain similar pragmatic abilities to that of their monolingual peers.[404]

The ability to maintain proficient levels of two languages on par with monolingual peers with ASD may extend into the school-aged years for at least some children with ASD, despite the increasing language demands that accompany an increase in age. Beauchamp and colleagues found that simultaneous French-English bilingual school-aged children (six to nine-years old) with ASD performed on par with monolingual children with ASD, and monolingual and bilingual neurotypically developing children with similar cognitive abilities on all French-language

[401] Hambly and Fombonne, "The Impact of Bilingual Environments," 1342–52. Reetzke and colleagues also found no difference in age of onset of first words between bilingually exposed and monolingual Chinese children with ASD. Rachel Reetzke et al., "Communicative Development in Bilingually Exposed Chinese Children with Autism Spectrum Disorders," *JSLHR* 58, no. 3 (2015): 9.

[402] Reetzke et al., "Communicative Development," 1–13. For more evidence in toddlers and young children, see Sunitha Sendhilnathan and Shyamala K. Chengappa, "Effect of Language Intervention on Mean Length of Utterance in Monolingual and Bilingual Children with Autism Spectrum Disorders in a Multi-Ethnic-Lingual Context," *Language in India* 20, no. 2 (2020): 66–85; Yael G. Dai et al., "Language Abilities in Monolingual- and Bilingual- Exposed Children with Autism or Other Developmental Disorders," *Research in Autism Spectrum Disorders* 55 (2018): 38–49; Valicenti-McDermott, Seijo, and Shulman, "Social Differences," 55–59; Zhou et al., "An Exploratory Longitudinal Study," 1–19; Hastedt et al., "Bilingual and Monolingual Autistic Toddlers," 2185–202.

[403] Jill M. Petersen, Stefka H. Marinova-Todd, and Pat Mirenda, "Brief Report: An Exploratory Study of Lexical Skills in Bilingual Children with Autism Spectrum Disorder," *JADD* 42, no. 7 (2012): 1499–503.

[404] Reetzke et al., "Communicative Development," 1–13.

measurements. Additionally, the language patterns in both English and French of the bilingual children with ASD did not differ from those of the neurotypically developing bilingual children.[405] Gonzalez-Barrero and Nadig measured the receptive vocabulary and expressive morphological skills of monolingual and bilingual school-aged children (ages five to ten) with ASD. They found that the bilingual sample scored lower than their monolingual peers on both measurements in their dominant language, with vocabulary lagging further behind their peers than morphology. While the measurements of receptive vocabulary for the bilingual group fell within the average range, their measurements of expressive morphology fell slightly below the average range. Though the bilingual children lagged behind the monolingual, their language abilities conform to the pattern of TD bilingual children.[406]

The language abilities of bilingual children with ASD can remain on par with their peers not only for receptive language measures, but advanced expressive skills as well. Hoang and colleagues measured the narrative abilities of monolingual and bilingual children with and without ASD and found that the narrative abilities of the bilingual children with ASD were on par with their monolingual peers, and that both bilingual

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[405] Beauchamp, Rezzonico, and MacLeod, "Bilingualism in School-Aged Children," 4433–48. In both French and English, participants were tested on receptive vocabulary and overall receptive and expressive abilities.

[406] Ana Maria Gonzalez-Barrero and Aparna Nadig, "Brief Report: Vocabulary and Grammatical Skills of Bilingual Children with Autism Spectrum Disorders at School Age," *JADD* 49, no. 9 (2019): 3888–97. The authors note that the discrepancy between their findings and previous findings which do not demonstrate a discrepancy between receptive vocabulary scores between monolingual and bilingual children with ASD may be due to several factors, including their inclusion criteria for bilingual children (proficient bilingual, as opposed to bilingually-exposed). Additionally, children with language impairment were included in the sample. Andreou and colleagues found that their bilingual sample of children with ASD, aged seven to fifteen, performed more poorly on the measurement of expressive vocabulary than their monolingual peers, but outperformed them on measurements of grammar as measured by a sentence repetition task. Maria Andreou et al., "Theory of Mind, Executive Functions, and Syntax in Bilingual Children with Autism Spectrum Disorder," *Languages* 5, no. 4 (2020): 1–24. For further evidence of similar language abilities in monolingual and bilingual children with ASD, see Vanegas, "Academic Skills," 5; Meir and Novogrodsky, "Syntactic Abilities and Verbal Memory," 10, 17.

groups outperformed the monolingual groups on number of utterances produced.[407] Meir and Novogrodsky found that Russian-Hebrew bilingual children with High Functioning Autism performed on par with their monolingual counterparts with ASD in a pronoun elicitation task. Additionally, no statistical difference was found between the bilingual children with ASD and the TD bilingual participants in terms of pronoun omissions, whereas as the monolingual participants with ASD performed significantly different than their monolingual TD counterparts. The authors suggest that bilingualism may confer linguistic benefits to children with ASD when the languages share similar linguistic features as do Russian and Hebrew.[408]

Emerging evidence suggests that bilingualism may confer a variety of cognitive benefits to children with ASD.[409] Children with ASD typically display deficits in working memory, executive function, Theory of Mind, and other cognitive functions, and bilingualism may help to mitigate these deficits.[410] Bilingualism may mitigate

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[407] Hoang, Gonzalez-Barrero, and Nadig, "Narrative Skills of Bilingual Children," 3–33. Peristeri and colleagues found select advantages for bilingual children with ASD over their monolingual peers for narrative abilities. Eleni Peristeri, et al., "The Impact of Bilingualism on the Narrative Ability and the Executive Functions of Children with Autism Spectrum Disorders," *JOCD* 85 (2020): 1–22.

[408] Meir and Novogrodsky, "Prerequisites of Third-Person Pronoun Use," 1–14.

[409] In their study of preschool aged children with ASD, Petersen and colleagues found significantly higher NVIQ among the bilingual group. Petersen, Marinova-Todd, and Mirenda, "Brief Report," 1501–2. Peristeri and colleagues found that bilingualism confers strong positive benefits to the overall intellectual functioning of bilingual children with ASD from a low socioeconomic status background. Eleni Peristeri, Silvia Silleresi, and Ianthi Maria Tsimpli, "Bilingualism Effects on Cognition in Autistic Children are Not All-or-Nothing: The Role of Socioeconomic Status in Intellectual Skills in Bilingual Autistic Children," *Autism* 26, no. 8 (2022): 2084–97.

[410] For executive function see Eleni A. Demetriou et al., "Autism Spectrum Disorders: A Meta-Analysis of Executive Function," *Molecular Psychiatry* 23, no. 5 (2018): 1198–204; Elizabeth Pellicano et al., "Multiple Cognitive Capabilities/Deficits in Children with an Autism Spectrum Disorder: 'Weak' Central Coherence and its Relationship to Theory of Mind and Executive Control," *Development and Psychopathology* 18, no. 1 (2006): 77–98; Michael Rosenthal et al., "Impairments in Real-World Executive Function Increase from Childhood to Adolescence in Autism Spectrum Disorders," *Neuropsychology* 27, no. 1 (2013): 13–18; Robin E. McEvoy, Sally J. Rogers, and Bruce F. Pennington, "Executive Function and Social Communication Deficits in Young Autistic Children," *Journal of Child Psychology and Psychiatry* 34, no. 4 (1993): 563–78. Working memory is considered a domain of executive function which, along with generativity and flexibility, may be especially weak in individuals with ASD after controlling for the

deficits for children with ASD in select domains of executive functioning such as cognitive flexibility, generativity, set-shifting, inhibition, and sustained attention.[411] Executive function benefits of bilingualism have been demonstrated not only in clinical experimental tasks but also in daily life tasks as measured by parental reports.[412] Gonzalez-Barrero and Nadig found that bilingual children with ASD aged five to ten outperformed their monolingual counterparts with ASD matched on age, NVIQ, and receptive vocabulary skills in their dominant language on the number of correctly produced lexical items in a semantic category and posit that bilingualism may grant

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effects of ADHD. Chun Lun Eric Lai et al., "Meta-Analysis of Neuropsychological Measures of Executive Functioning in Children and Adolescents with High-Functioning Autism Spectrum Disorder," *Autism Research* 10, no. 5 (2017): 911–39. For Theory of Mind see Yael Kimhi, "Theory of Mind Abilities and Deficits in Autism Spectrum Disorders," *Topics in Language Disorders* 34, no. 4 (2014): 329–43; Livia Colle, Simon Baron-Cohen, and Jacqueline Hill, "Do Children with Autism Have a Theory of Mind? A Non-Verbal Test of Autism vs. Specific Language Impairment," *JADD* 37 (2007): 716–23; Nurit Yirmiya et al., "Meta-Analyses Comparing Theory of Mind Abilities of Individuals with Autism, Individuals with Mental Retardation, and Normally Developing Individuals," *Psychological Bulletin* 124, no. 3 (1998): 283–307.

[411] For cognitive flexibility see Eleni Peristeri, Margreet Vogelzang, and Ianthi Maria Tsimpli, "Bilingualism Effects on the Cognitive Flexibility of Autistic Children: Evidence from Verbal Dual-Task Paradigms," *Neurobiology of Language* 2, no. 4 (2021): 558–85; Eleni Peristeri et al., "The Cognitive Benefits of Bilingualism in Autism Spectrum Disorder: Is Theory of Mind Boosted and by Which Underlying Factors?," *Autism Research: Official Journal of the International Society for Autism Research* 14, no. 8 (2021): 1695–709. It should be noted that given current measurements of executive functioning, it is often difficult to pinpoint which domains are responsible for success in a task, as one task may tap into multiple executive functioning skills. Peristeri et al., "The Cognitive Benefits of Bilingualism," 1705.

[412] Allison B. Ratto et al., "Parents Report Fewer Executive Functioning Problems and Repetitive Behaviors in Young Dual-Language Speakers with Autism," *Child Neuropsychology* 26, no. 7 (2020): 917–33; Shereen Sharaan, Sarah E. MacPherson, and Sue Fletcher-Watson, "The Impact of Bilingualism on Everyday Executive Functions of English-Arabic Autistic Children: Through a Parent-Teacher Lens," *JADD* 52 (2022): 2224–35; Ratto, Reimann, and Nadwony, "Dual Language Learning," 5007–17. Iarocci and colleagues found that children with ASD exposed to a second language did not differ from their peers with ASD in parental reports of functional communication and executive function abilities. However, children with ASD with second language exposure were significantly less likely to fall into the clinically significant range for executive function abilities. Grace Iarocci, Sarah M. Hutchison, and Gillian O'Toole, "Second Language Exposure, Functional Communication, and Executive Function in Children with and without Autism Spectrum Disorder (ASD)," *JADD* 47 (2017): 1818–29. However, see Ana Maria Gonzalez-Barrero and Aparna S. Nadig, "Can Bilingualism Mitigate Set-Shifting Difficulties in Children with Autism Spectrum Disorders?," *Child Development* 90, no. 4 (2019): 1043–60 for no advantage of bilingualism according to parental measures.

children with ASD “enhanced *generativity* or *response initiation*” (italics original).[413] Additionally, in a separate study, they found a bilingual advantage for set-shifting tasks, a domain of executive function, for school-aged children with ASD in experimental tasks, though the same advantage was not found in daily-life tasks.[414] Li and colleagues found that in a sample of school-aged children with ASD the Japanese-English bilingual children performed more rapidly than the monolingual sample on a measurement of inhibition, suggesting that bilingualism may confer some executive function advantage to children with ASD.[415] Additionally, Montgomery and colleagues found a bilingual advantage for motor impulsivity, while Sharaan and colleagues found an advantage for sustained attention.[416] While the evidence for a clear advantage in executive functioning

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[413] Ana Maria Gonzalez-Barrero and Aparna Nadig, “Verbal Fluency in Bilingual Children with Autism Spectrum Disorders,” *Linguistic Approaches to Bilingualism* 7, no. 3-4 (2017): 470.

[414] Ana Maria Gonzalez-Barrero and Aparna S. Nadig, “Can Bilingualism Mitigate Set-Shifting Difficulties in Children with Autism Spectrum Disorders?,” *Child Development* 90, no. 4 (2019): 1043–60. For evidence of a bilingual advantage of executive functioning skills in children with ASD according to parental reports, see Sharaan, MacPherson, and Fletcher-Watson, “The Impact of Bilingualism on Everyday Executive Functions,” 2224–35. Iarocci and colleagues found that children with ASD exposed to a second language did not differ from their peers with ASD in parental reports of functional communication and executive function abilities. However, children with ASD with second language exposure were significantly less likely to fall into the clinically significant range for executive function abilities. Grace Iarocci, Sarah M. Hutchison, and Gillian O’Toole, “Second Language Exposure, Functional Communication, and Executive Function in Children with and without Autism Spectrum Disorder (ASD),” *JADD* 47 (2017): 1818–29.

[415] Hiukei Li, Manabu Oi, Keiko Gondo, and Tomoko Matsui, “How Does being Bilingual Influence Children with Autism in the Aspect of Executive Functions and Social and Communication Competence?,” *Journal of Brain Science* 47 (2017): 21–49.

[416] Lewis Montgomery et al., “Measuring the Impact of Bilingualism on Executive Functioning via Inhibitory Control Abilities in Autistic Children,” *JADD* 52, no. 8 (2022): 3560–73; Shereen Sharaan, Sue Fletcher-Watson, and Sarah E. MacPherson, “The Impact of Bilingualism on the Executive Functions of Autistic Children: A Study of English–Arabic Children,” *Autism Research* 000 (2020): 1–12. It should be noted that Sharaan and colleagues found a bilingual advantage for children with ASD in only one component of sustained attention. The bilingual participants with ASD had fewer false starts on the psychomotor vigilance task than their monolingual counterparts with ASD as well as the bilingual and monolingual TD controls, but such as advantage was not found for reaction time. Sharaan, Fletcher-Watson, and MacPherson, “The Impact of Bilingualism,” 9. For further evidence of a bilingual advantage in executive functioning skills in children with ASD, see Peristeri et al., “The Impact of Bilingualism on the Narrative Ability,” 1–22; Andreou et al., “Theory of Mind,” 1–24; Eleni Baldimtsi et al., “The Impact of Bilingualism on Theory of Mind and Executive Functions in TD and ASD,” in *Proceedings of the 44th*

for bilingual children with ASD is still preliminary, the evidence makes clear that bilingualism poses no detrimental effect to the executive functions of bilingual children with ASD, even into adolescence.[417] Furthermore, bilingualism seems to also benefit the Theory of Mind abilities of children with ASD.[418]

Multiple factors influence bilingual language development in children with ASD, some of which are similar to bilingual development in TD children. The strongest factor in L2 language development for children with ASD seems to be recent direct exposure to the L2. Hambly and Fambonne found that among bilingually exposed children with ASD aged three to seven years old, recent direct L2 exposure accounted for 69 percent of the variance of expressive L2 vocabulary abilities, while cognitive and social skills did not seem to be important factors.[419] Most children with low or no expressive bilingual abilities were only receiving indirect exposure to the L2 at the time of the study, and the authors conclude that direct exposure to the L2 is critical for L2 development in children with ASD.[420] Other significant factors to L2 language

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annual Boston University Conference on Language Development, ed. Megan M. Brown and Alexandra Kohut (Somerville, MA: Cascadilla Press, 2020), 40–52.

[417] For evidence of no negative effect in adolescence, see Iarocci, Hutchison, and O'Toole, "Second Language Exposure," 1826.

[418] Andreou et al., "Theory of Mind," 1–24; Baldimtsi et al., "The Impact of Bilingualism on Theory of Mind," 40–52; Peristeri et al., "The Cognitive Benefits of Bilingualism," 1695–709.

[419] In this study, L2 was defined as the language spoken less often to the child across the child's lifetime. Catherine Hambly and Eric Fombonne, "Factors Influencing Bilingual Expressive Vocabulary Size in Children with Autism Spectrum Disorders," *Research in Autism Spectrum Disorders* 8, no. 9 (2014): 1079–89. Similarly, Gonzalez-Barrero and Nadig found that current language exposure accounted for 67 percent of variance in receptive vocabulary and 49 percent of the variance in morphological skills in school-aged children with ASD. Ana Maria Gonzalez-Barrero and Aparna Nadig, "Bilingual Children with Autism Spectrum Disorders: The Impact of Amount of Language Exposure on Vocabulary and Morphological Skills at School Age," *Autism Research* 11, no. 12 (2018): 1667–78.

[420] Li, Oi, and Matsui, "How Does being Bilingual Influence Children," 21–49.

development for children with ASD are expressive vocabulary, working memory, and chronological age.[421]

It seems that given sufficient exposure to an L2 some children with ASD can become successful bilinguals. Exposure to a second language does not negatively affect the development of children with ASD, and may confer cognitive, linguistic, and social benefits in childhood. Additionally, bilingualism may lead to a more satisfying social life in adulthood.[422] The most important factor in bilingual success for children with ASD seems to be current exposure to the language, and parents should not be discouraged from speaking their home language to their child.

Only one study examines development in bilingually exposed children with a dual diagnosis of DS and ASD. Ward and Sanoudaki explored the language and cognitive profiles of four bilingually exposed children with a dual diagnosis of DS and ASD using a multiple case study design.[423] The four case studies were compared to monolingual and bilingual children with DS and TD bilingual children matched on measurements of NVC, general language abilities, expressive morphosyntax, phonological awareness, and working memory. Each case study was compared to the three control groups using a modified *t*-test designed for single case study comparison. Though each child exhibited a distinct profile, the bilingual children with a dual diagnosis did not differ significantly from bilingual and monolingual children with DS, with one exception, in which one child

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[421] For expressive vocabulary see Hambly and Fombonne, "Factors Influencing Bilingual Expressive Vocabulary," 1079–89. Gonzalez-Barrero and Nadig found that age and working memory were significant factors in expressive morphological skills and working memory for receptive vocabulary skills. Gonzalez-Barrero and Nadig, "Bilingual Children with Autism Spectrum Disorders," 1667–78.

[422] Digard and colleagues found that adults with ASD who knew two or more languages were more satisfied with their social life than those that knew only one. Bérengère G. Digard et al., "Bilingualism in Autism: Language Learning Profiles and Social Experiences," *Autism* 24, no. 8 (2020): 2166–77.

[423] Rebecca Ward and Eirini Sanoudaki, "Bilingualism in Children with a Dual Diagnosis of Down Syndrome and Autism Spectrum Disorder," *Clinical Linguistics & Phonetics* 35, no. 7 (2021): 663–89.

with a dual diagnosis scored lower on the basic concepts subtest in English. While some case studies performed lower than the bilingual TD group on some measurements, others significantly outperformed the bilingual TD group on other measurements. However, the abilities in each language of the bilingual children with a dual diagnosis reflected the amount of input they received in each language. Unlike monolingual children with a dual diagnosis, the bilingual case studies in this study displayed receptive and expressive language abilities on par with their peers with DS only. This seminal study indicates that bilingually exposed children with a dual diagnosis seem to develop language skills on par with their monolingual and bilingual peers with DS, demonstrating that bilingualism poses no additional threat to the language development of children with a dual diagnosis of DS and ASD.

CHAPTER 3

METHODOLOGICAL DESIGN

This chapter describes the procedures and methods used in the present study to assess the lexical development of Spanish as a second language in the FL context in children with DS and participation of children with DS in the FL classroom. Included are the purpose statement, research questions, design overview, research population, research delimitations, limits of generalization, instrumentation, and procedures.

Purpose Statement

The purpose of this study was to describe the participation of elementary-aged children with Down syndrome with and without a comorbid diagnosis of ASD in a six-week foreign language class and to measure the receptive and expressive lexical acquisition of Spanish as a foreign language in students with Down syndrome.

Research Question Synopsis

The research questions explored two major categories: participation of students with Down syndrome in the foreign language classroom and the initial stages of second language acquisition in children with Down syndrome. Due to the effect of ASD on language development and the small number of participants with ASD, research questions 1 and 2 (sub-question A) examine data from the participants with DS only and participants with a dual diagnosis of ASD, whereas research questions 3 through 5 examine data from participants with DS only.

1. How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?

a. How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?

b. How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?

c. What barriers exist to their participation in the foreign language classroom?

d. What type of support do children with Down syndrome need to successfully participate in the foreign language classroom?

e. What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?

2. To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?

    a. How does the acquisition of second language vocabulary in a six-week foreign language classroom of children with a dual diagnosis of ASD differ from that of their peers with DS only?

3. Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?

4. Which select variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome?

5. Do L1 vocabulary levels of children with Down syndrome change over the course of a six-week FL class as measured by a standardized assessment?

Design Overview

This research utilized an exploratory mixed methods multiple case study design. A mixed methods multiple case study design was employed to develop an enhanced understanding of initial second language acquisition in children with DS with and without a dual diagnosis of ASD through the collection of both quantitative and qualitative data and the analysis of multiple cases.[1] The method of case studies is applicable, since there is very little research conducted on the nature of second language

[1] John W. Creswell and Vicki L. Plano Clark, *Designing and Conducting Mixed Methods Research*, 3rd ed. (Los Angeles: SAGE, 2018), 116.

acquisition in individuals with DS, especially in the FL context.[2] In line with the exploratory mixed methods research design this study consisted of three main phases: qualitative, instrumentation development, and a quantitative assessment including implementation of the instrumentation.[3] The quantitative data of those students participating in the case studies was combined with their qualitative data to provide a fuller and more complete description of the initial stages of L2 acquisition in the FL context in children with DS through "the generation of . . . multiple cases."[4] Additionally, the quantitative data on all participants, not just those participating in the case studies, was analyzed to compare the receptive and expressive lexical acquisition of children with DS, to compare the acquisition of children with a dual diagnosis to that of children with DS only, to determine which variables correlate with L2 acquisition in children with DS in the FL context, and to determine the impact of participation in the FL classroom on L1 vocabulary development.

Phase 1: Qualitative

The first phase of an exploratory mixed methods research design involves the "collection and analysis of qualitative data."[5] The first phase of the present study consisted of two primary components: implementation of an intervention, that is, teaching Spanish to children with DS, and multiple case studies of children with DS who were participating in the Spanish FL classroom. Prior to the intervention, all participants were given three categories of assessments: nonverbal intelligence, English vocabulary,

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[2] Paul D. Leedy and Jean Ellis Ormrod, *Practical Research: Planning and Design*, 11th ed. (New York: Pearson, 2016), 254; Sue Buckley recommends case studies as a starting point for researching L2 acquisition in children with DS. Sue Buckley, "Can Children with Down Syndrome Learn More Than One Language?," *Down Syndrome News and Update* 2, no. 3 (2002): 100.

[3] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 84.

[4] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 106.

[5] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 84.

and a measurement of VSTM. These assessments served to develop a profile for each participant and serve as a predictor measure for how participants may differ in their acquisition of Spanish.[6] L1 control group participants were also administered a battery of tests measuring nonverbal intelligence and English vocabulary.

The intervention lasted for six weeks, during which time all participants attended Spanish class every day, Monday through Friday, for forty-five minutes. The six weeks was divided into two three-week sessions, with a week of no class in-between. An intensive class may be more appropriate for children with DS, as opposed to meeting once a week over an extended period of time, since frequency is a crucial factor in L2 learning for children with DS.[7] The classes took place in a classroom at Down Syndrome of Louisville (DSL), an organization in Louisville, Kentucky which provides "comprehensive, specialized developmental and educational services for individuals with Down Syndrome."[8] The classes took place during the six-week academic enrichment summer camp held at DSL, and were part of the camp curriculum. I taught the Spanish classes, while the regular classroom teachers served as assistants during Spanish class. Each class had three classroom teachers, resulting in an average ratio of one assistant per three to four children. Assistants were trained before classes began on their role and proper protocol in Spanish class.

There were three distinct classes which served different age groups and developmental levels: lower, middle, and upper. Class placements were based upon a

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[6] Elena Tribushinina, Elena Dubinkina-Elgart, and Nadezhda Rabkina, "Can Children with DLD Acquire a Second Language in a Foreign-Language Classroom? Effects of Age and Cross-Language Relationships," *JOCD* 88 (2020): 10.

[7] Elizabeth Kay-Raining Bird, "The Case for Bilingualism in Children with Down Syndrome," in *Language Disorders from a Developmental Perspective*, ed. Rhea Paul (Mahwah, NJ: Lawrence Erlbaum Associates, 2007), 267.

[8] Down Syndrome of Louisville, "Our Local Service Area," accessed March 9, 2022, https://dsoflou.org/about-us/our-local-service-area/.

complex mixture of factors including CA, grade completed, academic needs and abilities, and needed behavioral support.[9] Each class had between six to nine students, though the number varied between sessions one and two. Instruction in the class took place in Spanish, while English was utilized mainly for classroom management, and to establish meaning of the Spanish language when necessary. The curriculum was based upon principles of communicative language teaching, in which "meaningful communication and language use (is the) focus of all classroom activities."[10] Rather than focusing on the formal properties of the language through the study of grammar, with an emphasis on translation and memorization, the focus of instruction was on communication using the L2. The primary means of instruction was through story listening, acting out the stories, Total Physical Response (TPR), music, and games.[11] The stories told in class were made into picture books and sent home with the students each time a new story was presented in class. Parents were encouraged to read the books with their children at home, but not required. Each book had a QR code linked to a recording of me reading the book so that those parents that do not read in Spanish could follow along with their children at home.[12]

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[9] Class placement decisions were made by staff at DSL.

[10] Jack C. Richards and Richard W. Schmidt, *Longman Dictionary of Language Teaching and Applied Linguistics*, 4th ed. (London: Pearson, 2013), 99.

[11] Story listening is a strategy in which the teacher tells a story in the target language, making it comprehensible through pictures, drawings, gestures, and limited use of the L1. Beniko Mason et al., "The Effects and Efficiency of Hearing Stories on Vocabulary Acquisition by Students of German as a Second Foreign Language in Japan," *Indonesian Journal of English Language Teaching* 5, no. 1 (2008): 4. TPR is a strategy in which students hear a command or action spoken in the target language, see it modeled, then perform the action themselves. James J. Asher, "The Total Physical Response Approach to Second Language Learning," *The Modern Language Journal* 52, no. 1 (1969): 4. In their review on age-related factors and FL learning, Marianne Nikolov and Jelena Mihaljević Djigunović recommend that given the time and input constraints of the elementary FL classroom and the cognitive profiles of young children, FL teaching in the elementary classroom should mimic as much as possible "natural" language learning. Marianne Nikolov and Jelena Mihaljević Djigunović, "Recent Research on Age, Second Language Acquisition, and Early Foreign Language Learning," *Annual Review of Applied Linguistics* 26 (2006): 242. The strategies employed in the Spanish intervention were intended to use the language in a way which children would naturally use language, through stories, music, games, action, and play.

[12] The methods of teaching used in the intervention align well with those described by Joy and

During the intervention phase, five children took part in a case study. Multiple sources of information aided in providing a fuller picture of each child's acquisition and their experience in the class.[13] Data for the case studies was collected through video recording, observation and journaling, and surveys and interviews. Classes were video recorded so that I could accurately record the habits of participation and evidence of acquisition of the Spanish language as demonstrated in the classroom of those students participating in the case studies.[14] I also kept an electronic journal in which I recorded my thoughts and observations of the classes, particularly of the children participating in the case studies. The assistants provided their feedback through daily journaling, for which I provided the prompts, a survey after the first three weeks, and a survey and interview at the end of the course. Finally, parents provided feedback concerning their child's attitude and use of Spanish outside of the classroom through a survey after the course. In addition, at the end of the intervention parents of all participants were given a brief survey to document their child's out-of-class exposure to Spanish. Case study journal observation questions, mid- and post-intervention assistant survey and interview

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Murphy in their study of eight grade-six inclusive intensive French as a second language classes. These classes, which included children with special education needs, including at least one with DS, used strategies such as music, drama, and easy to read books which children take home with them, all of which were used in my class. Teaching techniques such as scaffolding, modeling, and pictures for comprehension support were also be employed. As in the classes described by Joy and Murphy, the goal of my class was for "students (to learn) without knowing that they're learning . . . having fun and learning at the same time." Joy and Murphy, "The Inclusion of Children with Special Educational Needs," 111. In the post intervention interviews, one teacher commented that the student has a positive experience because "Teaching (was) through playful activities or fun stories," and that the child "wanted to do it because it was fun and didn't realize that he was being taught something." Additionally, Barwasser and colleagues found that storytelling is an effective strategy to teach vocabulary to students with learning disabilities. Barwasser, Knaak, and Grünke, "The Effects of a Multicomponent Storytelling Intervention," 35–53. Olmeda Casanova found music to be an effective strategy to teach FL vocabulary to a child with DS. Roberto Olmeda Casanova, "The Effect of Using Music as a Socio-Affective Strategy to Teach English to a Second Grade Down Syndrome Student" (EdD diss., University of Puerto Rico, 2012).

[13] Leedy and Ormrod, *Practical Research*, 253–54.

[14] Permission to be recorded for the purposes of data collection was received from all parents of students participating in the classes, both intervention and non-intervention participants.

questions, and the post-intervention parental survey can be found in appendices seven through eleven.

Phase 2: Instrumentation Development

The second phase of an exploratory mixed methods research design is intended to serve as a bridge between the qualitative data and quantitative data collection. In phase 2 the researcher typically creates an instrument based off of the qualitative data collected in phase 1 in order to collect quantitative data in the third phase.[15] The purpose of such instrumentation development is to base the quantitative feature on "the culture or setting of participants rather than (pulling it) 'off the shelf' for use. With the culture-specific development of the measure or instrument, the likelihood increases that it will be seen as relevant to the group being studied."[16]

Such a "culture-specific" instrumentation was needed in this context to truly capture the acquisition of the participants in the class and is not without precedent. In their study of FL acquisition of children with Developmental Language Disorder, Tribushinina and colleagues found that standardized tests did not truly capture "the material that the children were directly exposed to in their English lessons and may not have been sensitive enough to measure growth in this population." They thus recommend that future studies develop assessments which "directly (address) the material covered (in the) lessons."[17] In their study of FL acquisition of children with special needs, Peker and Regalla administered an assessment of L2 vocabulary based upon each thematic unit, though they used no standardized measurement of L2 language acquisition.[18] Though not

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[15] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 84.

[16] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 84.

[17] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14.

[18] Hilal Peker, and Michele Regalla, "Making Exemption the Exception, Not the Rule:

in the context of children with special needs, Nicolay and Poncelet administered tests of L2 vocabulary designed to "directly probe the vocabulary learned at school" for immersion students at the end of kindergarten and first grade, while they administered standardized tests at the end of second grade.[19]

Thus, during the second phase of this study, I developed instrumentation with which to assess the Spanish lexical acquisition of all participants in the class. I developed one instrument to assess receptive lexical acquisition and one instrument to assess expressive lexical acquisition. This instrumentation was modeled off of standardized instrumentation used in other studies to assess lexical acquisition of Spanish but used vocabulary from the class curriculum. Thus, while the format of the assessments was similar to that of standardized assessments commonly used in the field of language acquisition, the content of the assessments was tailored to the input participants had received in the class. The development of my own instrumentation is in line with a three-phase exploratory mixed methods design "in which the researcher first begins by exploring with qualitative data and analysis, then builds a feature to be tested . . . and tests this feature in a quantitative third phase."[20] While instrumentation development typically occurs after the completion of phase 1, due to the short nature of the course (six weeks), instrumentation development took place simultaneously with the course, based on the planned curriculum.

Phase 3: Quantitative Assessment

The third phase of an exploratory mixed methods design is that in which

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Inclusion of All Students in Foreign Language Education," *Foreign Language Annals* 54, no. 1 (2021): 80.

[19] Anne-Catherine Nicolay and Martine Poncelet, "Cognitive Abilities underlying Second-Language Vocabulary Acquisition in an Early Second-Language Immersion Education Context: A Longitudinal Study," *Journal of Experimental Child Psychology* 115, no. 4 (2013): 661–62.

[20] John W. Creswell and J. David Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. (Los Angeles: SAGE, 2017), 224.

quantitative data is gathered though the implementation of the instrumentation created in phase 2.[21] The quantitative portion of this study assessed the receptive and expressive lexical development in Spanish of the intervention participants. For each domain (receptive and expressive) I administered a standardized test and my own instrumentation which I developed in the second stage. The use of standardized tests will allow the research to be replicated in future studies and allows for a more standardized comparison. However, since the development of my own instrumentation "(captured) the material that the children were directly exposed to" in class, it "may reveal better performance and give a wider range of performance" than what can be captured through the standardized assessments.[22] Results from these assessments were analyzed to compare the Spanish receptive and expressive lexical development of the intervention participants, compare the acquisition of participants with a dual diagnosis of ASD to those with DS only and to determine which variables correlate to L2 acquisition in children with DS in the FL context. The qualitative and quantitative data was then combined to provide an overall language acquisition profile of each child who participated in the case studies.

Additionally, in this phase all participants, including the L1 control group of students with DS, were administered English vocabulary assessments to measure their L1 vocabulary. The results of the post-intervention English vocabulary assessments were compared to the pre-intervention English vocabulary assessments to measure any change in participants' L1 vocabulary skills. The results of these assessments helped to answer the question of the impact of participation in the FL classroom on the L1 development of children with DS and were also included in the overall language acquisition profile of the

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[21] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 87.

[22] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14.

case study participants.[23]

Research Population and Sample

The research population is monolingual English-speaking children with DS. The research sample consisted of thirteen (kindergarten–sixth grade) monolingual English-speaking children with DS attending the summer academic enrichment camp at DSL. With one exception, these intervention participants had no significant prior exposure to the Spanish language, nor were they enrolled in any other type of Spanish language learning class for the duration of the study. One participant had participated in a schoolyear of Spanish classes two years prior but did not seem to recall any Spanish during pre-intervention assessments. All intervention participants had a diagnosis of DS, as reported by a parent or guardian, and had not experienced a traumatic brain injury. Parents indicated if their child had a dual diagnosis of ASD. Since autism is a confounding factor for language development, the data of the three participants with a dual diagnosis was analyzed separately. All participants were reported to have no more than mild hearing loss. Though hearing loss affects language acquisition, to exclude all participants with hearing loss may have excluded a large portion of the DS population and would thus not be representative of the DS population.[24] Intervention participant ages, grades, NVC scores, and Spanish class attended can be seen in table A1 in appendix 18.

Each of the three classes consisted of six to nine students with DS, though not all students in the class participated in data collection. Contrary to the typical practice of a three-phase exploratory mixed methods research design in which separate research

[23] In the final analysis, the L1 control group data was not considered, to be discussed further in chapter 5. However, I have retained in my explanation information regarding the participation and assessment of the L1 control since I gathered data on them with the intention of utilizing it.

[24] For similar criterion see Rebecca Ward, "Profiling the Language Abilities of Welsh-English Bilingual Children with Down Syndrome" (PhD diss., Bangor University, 2020), 102–3.

participants are used in phase 1 than in phase 3, the same participants participated in both the qualitative and quantitative portions of the study. While the exploratory mixed methods design typically uses random sampling in the quantitative phase so as to "objectively generalize the results to a population," this research necessitated that those students who participated in the class, based off of which the instrumentation was formed, be the same participants who received the assessment.[25] Thus, the reasons for using different populations in the quantitative and qualitative phases of the study offered in the literature were not applicable in this study.[26]

The research sample of children with DS was recruited primarily through DSL, and were not drawn from one school, but from all over the greater Louisville metro area. All intervention participants also attended the summer academic enrichment camp at DSL. Of those children that participated in the Spanish intervention one or two per class were part of the multiple case study, for a total of five case studies.[27] Before the start of classes, a general invitation was extended to parents of all intervention participants for their child to participate in a case study. They were provided with an information sheet which outlined what would be required of them and their child for the child to participate in the case study. In order to secure a sufficient number of case studies, follow-up invitations were extended via email to parents of select students. These invitations were based upon classroom placement and pre-intervention NVC and L1 vocabulary scores, with the intention of having at least one case study per class representing a variety of

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[25] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 193.

[26] See Creswell and Creswell, *Research Design*, 225; Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 192–93.

[27] The number of intervention participants far exceeded the recommended number of participants for a multiple case study. While everyone's data was included in the quantitative assessment of language acquisition, it was not feasible to conduct an in-depth case study of every participant in the study. Creswell and Poth offer four to five cases as the norm for multiple case studies. John W. Creswell and Cheryl N. Poth, *Qualitative Inquiry and Research Design: Choosing among Five Approaches* (Los Angeles: SAGE, 2016), 161.

cognitive and linguistic abilities.

Additionally, as the Spanish classes were part of the curriculum of the academic enrichment summer camp at DSL, all participants of the camp attended the Spanish intervention, though not all chose to participate in the data collection. Parents of participants at the summer camp were given the option for their student not to attend Spanish class, though all agreed for their child to participate. Agreement to participate forms were collected from all camp participants. Finally, a separate control group of four monolingual English-speaking children with DS who did not participate in the Spanish intervention class were recruited for the purposes of investigating research question 5 (English vocabulary). The majority of the English vocabulary control group participants were recruited through direct recommendation by my contacts at DSL. Contacts at local churches and homeschool communities were also used to recruit L1 control group participants and pilot test participants. Pilot test participants consisted of thirteen monolingual English-speaking kindergarten through fifth grade TD children, four monolingual English-speaking children with DS (first through fifth grades), and one child with DS (fourth grade) whose L1 was Spanish.

Research Delimitations

This study assessed the receptive and expressive lexical acquisition of elementary-aged children with DS with and without a comorbid diagnosis of ASD. The focus of this study was lexical acquisition, as measurement of vocabulary is a meaningful assessment of language acquisition.[28] Moreover, vocabulary development may be

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[28] Batia Laufer and Zahava Goldstein note that "tests of vocabulary size have been shown to predict success in reading, writing, and general language proficiency as well as academic achievement." Batia Laufer and Zahava Goldstein, "Testing Vocabulary Knowledge: Size, Strength, and Computer Adaptiveness," *Language Learning* 54, no. 3 (2004): 401–2. See also Beatriz González-Fernández and Norbert Schmitt, "Vocabulary Acquisition," in *The Routledge Handbook of Instructed Second Language Acquisition*, ed. Shawn Loewen and Masatoshi Sato, Routledge Handbooks in Applied Linguistics (New York: Routledge, 2017), 280. J. Charles Alderson contends that vocabulary is a useful measure of language

especially important for syntactic development in individuals with intellectual disability such as DS, thus measuring vocabulary development is a reasonable first step to measuring initial language acquisition.[29] Given the limited exposure that students were to have to the language during the study, it was speculated that vocabulary production would likely be minimal.[30] Though some may have deemed that it was thus not worth measuring expressive vocabulary, since this study was the first of its kind and children with DS currently have limited access to participation in the FL classroom, it was decided to be advantageous to use this opportunity to measure participants' expressive vocabulary acquisition.[31] Assessing both the receptive and expressive lexical acquisition of participants presents a fuller picture of their acquisition and fluency (or lack thereof). This study did not assess reading abilities or writing abilities in Spanish. In addition, this

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proficiency, especially a knowledge of low-frequency words. J. Charles Alderson, "Judging the Frequency of English Words," *Applied Linguistics* 28, no. 3 (2007): 384. For the necessity of vocabulary for reading in L2, see Batia Laufer, "The Lexical Plight in Second Language Reading: Words You Don't Know, Words You Think You Know, and Words You Can't Guess," in *Second Language Vocabulary Acquisition: A Rationale for Pedagogy*, ed. James Coady and Thomas Huckin (Cambridge: Cambridge University Press, 1997), 20–34. For vocabulary and academic achievement, see Muriel Saville-Troike, "What Really Matters in Second Language Learning for Academic Achievement?," *TESOL Quarterly* 18, no. 2 (1984): 199–219.

[29] Monica Cuskelly, Jenny Povey, and Anne Jobling, "Trajectories of Development of Receptive Vocabulary in Individuals with Down Syndrome," *Journal of Policy and Practice in Intellectual Disabilities* 13, no. 2 (2016): 111; Margje van der Schuit et al., "How Cognitive Factors Affect Language Development in Children with Intellectual Disabilities," *RDD* 32, no. 5 (2011): 1884–94.

[30] Before the start of the study, it was suspected that the participants with DS may not be able to produce any significantly measurable amount of language after such limited contact with the language. Sharon Unsworth et al., "An Investigation of Factors Affecting Early Foreign Language Learning in the Netherlands," *Applied Linguistics* 36, no. 5 (2015): 532. See also Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 6.

[31] Per a Zoom conversation with Elizabeth Kay-Raining Bird, leading scholar in bilingualism in individuals with DS, on February 1, 2021. Additionally, Sini Smolander and colleagues note that previous studies investing L2 acquisition in children with DLD have largely neglected to investigate vocabulary acquisition, and "have rarely included both receptive and expressive modes." Sini Smolander et al., "L2 Vocabulary Acquisition of Early Sequentially Bilingual Children with TD and DLD Affected Differently by Exposure and Age of Onset," *IJLCD* 56, no. 1 (2021): 76. Thus, despite the limitations, the need exists to study both receptive and expressive vocabulary acquisition.

study did not assess grammatical acquisition.[32] Since exposure to the L2 was severely limited and individuals with DS are shown to have marked deficits in grammatical receptivity and expression, as well as difficulties in literacy skills, a longer intervention would be more effective to study grammar acquisition as well as reading and writing abilities.[33]

Additionally, this study intended to determine if participation in the FL class impacts L1 vocabulary development of children with DS as measured by a standardized assessment. The six-week span of this study offers only a limited time frame to measure L1 vocabulary growth in participants. While measurable growth may not be expected in such a time frame, it should be expected that the L1 vocabulary abilities of students would not significantly decrease under normal circumstances.

Furthermore, the intent of this study was to explore the initial stages of language acquisition in the FL context. The intervention only lasted for six weeks and thus is constrained by a limited time frame. Language acquisition is a slow process which requires thousands of hours of exposure.[34] During the span of this study, children were

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[32] By *grammatical* I am referring to the "syntactic and morphological properties of a language." Heike Behrens, "Grammatical Categories," in *The Cambridge Handbook of Child Language*, ed. Edith L. Bavin (Cambridge: Cambridge University Press, 2009), 200.

[33] In her review of the research, Alexandra Perovic concludes that the impaired linguistic abilities of individuals with DS "usually mean impaired grammar." Alexandra Perovic, "Syntactic Deficit in Down Syndrome: More Evidence for the Modular Organisation of Language," *Lingua* 116, no. 10 (2006): 1619. See also Leonard Abbeduto et al., "The Linguistic and Cognitive Profile of Down Syndrome: Evidence from a Comparison with Fragile X Syndrome," *DSRP* 7, no. 1 (2001): 11, 13; M. Koizumi, Y. Saito, and M. Kojima, "Syntactic Development in Children with Intellectual Disabilities–Using Structured Assessment of Syntax," *JIDR* 63, no. 12 (2019): 1438. For literacy skills see Kari-Anne B. Næss et al., "Reading Skills in Children with Down Syndrome: A Meta-Analytic Review," *RDD* 33, no. 2 (2012): 737–47; Gary E. Martin et al., "Language Characteristics of Individuals with Down Syndrome," *Topics in Language Disorders* 29, no. 2 (2009): 8–9; L. Verucci, D. Menghini, and S. Vicari, "Reading Skills and Phonological Awareness Acquisition in Down Syndrome," *JIDR* 50, no. 7 (2006): 477–91; Donna Boudreau, "Literacy Skills in Children and Adolescents with Down Syndrome," *Reading and Writing* 15, no. 5 (2002): 497–525; Elizabeth Kay-Raining Bird, Patricia L. Cleave, and Lyndsey McConnell, "Reading and Phonological Awareness in Children with Down Syndrome: A Longitudinal Study," *AJSLP* 9, no. 4 (2000): 319–30.

[34] Shiro Ojima et al., "Age and Amount of Exposure to a Foreign Language during Childhood:

exposed to approximately twenty-two and a half hours of Spanish language instruction. Since quantity of input is a key factor in FL vocabulary acquisition, only minimal amounts of acquisition were expected.[35] Despite this constraint, this reflects the reality of FL instruction, especially in the elementary years, and thus should be taken as a fairly accurate representation of what may be expected in the elementary FL context.[36] It is important to note that though the input was minimal, the frequency (five days a week for six weeks) is different from that of the typical elementary FL classroom where students may attend only once or twice a week. However, the compact nature of the classes may have proven beneficial for students, as frequency and intensity of exposure are key factors in L2 acquisition in bilingual children with DS.[37]

Behavioral and ERP Data on the Semantic Comprehension of Spoken English by Japanese Children," *Neuroscience Research* 70, no. 2 (2011): 203–4. It has been estimated that approximately ten years of living in country is necessary to reach ultimate attainment, though even this measurement is highly dependent upon quality interaction and input in the target language. Carmen Muñoz, "Symmetries and Asymmetries of Age Effects in Naturalistic and Instructed L2 Learning," *Applied Linguistics* 29, no. 4 (2008): 582–84. Muñoz calculates that in the FL language context, a learner would need 245 years to attain the same level of acquisition. Carmen Muñoz, "Contrasting Effects of Starting Age and Input on the Oral Performance of Foreign Language Learners," *Applied Linguistics* 35, no. 4 (2014): 3, 16n1. Given that Muñoz made her calculation based upon four one-hour sessions per week, in the elementary FL context, up to four times the length of said exposure, or even more, would be necessary.

[35] Collins and Muñoz contend that it would require a "considerable number of courses and additional practice time to reach anywhere close to a threshold of exposure that could result in even an intermediate level of FL knowledge." Laura Collins and Carmen Muñoz, "The Foreign Language Classroom: Current Perspectives and Future Considerations," *The Modern Language Journal* 100, no. S1 (2016): 138.

[36] A 2016 study published by the *Modern Language Journal* found that a typical FL class consists of approximately 37.5 hours of instruction. Collins and Muñoz, "The Foreign Language Classroom," 138. The format of elementary language instruction varies widely, with some classes meeting as little as once a week for twenty minutes, while the average varies "between two and five times per week, in sessions ranging from 15 to 60 minutes." Helena Curtain, Richard Donato, and Victoria Gilbert, "Elementary School Foreign Language Programs in the United States," in *Foreign Language Education in America: Perspectives from K–12, University, Government, and International Learning*, ed. Steven Berbeco (London: Palgrave Macmillan, 2016), 20.

[37] Natacha Trudeau et al., "Développement lexical chez les enfants bilingues avec Trisomie 21," *Enfance* 3, no. 3 (2011): 399; Rebecca Ward and Eirini Sanoudaki, "Language Profiles of Welsh-English Bilingual Children with Down Syndrome," *JOCD* 93 (2021): 12; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196; Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives on Child Language*

Finally, this study explored the initial stages of lexical acquisition by children with DS not only quantitatively but qualitatively through case studies. The case studies sought to describe the participation of children with DS in a six-week FL class and to describe how they demonstrate their acquisition of the Spanish language based upon observations. This was explored by describing how children with DS demonstrate their comprehension and non-comprehension in the FL classroom, what barriers exist to their participation, what types of support they need to successfully participate, and what activities they seem to enjoy most. While enjoyment of activity is neither a measurement of acquisition nor proof of acquisition, students' enjoyment of an activity is an important factor in their participation and ultimately, their acquisition. Students are more likely to be actively engaged in class if they are enjoying an activity, and active engagement is more likely to lead to acquisition than non-engagement as students will be open to receive the Spanish input, an important factor in acquisition. While it may be desirable to describe which activities in class led to the most acquisition, it is not possible to do so. In order to definitively determine which activities led to the most successful learning, each vocabulary word would need to be confined to one activity. However, most vocabulary words were not confined to one activity, but rather integrated throughout the various activities of the Spanish intervention. Therefore, a description of the participants' enjoyment of various activities is offered in sub-question E of research question 1 as a sort of proxy for which activities may have resulted in successful acquisition and to describe the students' participation in class more fully.

Limits of Generalization

Several limits exist to the generalization of the findings in this study. First, those participants with DS in this study may not be fully representative of all individuals

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Disorders, ed. Janet L. Patterson and Barbara L. Rodriguez (Bristol, UK: Channel View, 2015), 60.

with DS. The cognitive and language abilities of individuals with DS vary greatly, and it is possible that the lower or upper scale of language and cognitive abilities present in some individuals with DS was not fairly represented in the study. Secondly, the context of the class in which the students learned Spanish was not in the context of the school setting. Elementary FL programs vary vastly in the amount and frequency of exposure to the second language, as well as curriculum content and methodology.[38] Variance in any one of these factors will inevitably result in varying second language acquisition outcomes. While the frequency of exposure for this class was higher than what is typical for an elementary FL class, the duration of exposure was much less. Additionally, unlike a typical school setting, many participants in the study did not know each other apart from their participation in the summer camp. This could have raised their affective filter and lowered their receptibility to acquisition.[39] Therefore, the acquisition achieved by the students in the study may not be equal to what they might attain were the class in their own school with their classmates.

Finally, this study assessed the acquisition of Spanish vocabulary by native English speakers, and it should not be presumed that the same results would be obtained given different languages.[40] Spanish and English share the same alphabet and many

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[38] Curtain, Donato, and Gilbert, "Elementary School Foreign Language Programs," 19–20, 25–31.

[39] Krashen's Affective Filter hypothesis posits that when the affective filter is high, language acquisition decreases. See Stephen D. Krashen, *Principles and Practice in Second Language Acquisition*, internet ed., Stephen Krashen, 2009, 30–33. It should be noted, however, that most of these students were together all day for six weeks, so any barrier that the affective filter may have caused as a result of being unfamiliar with each other likely decreased as the camp progressed.

[40] Smolander et al. recognize that results of vocabulary acquisition may vary depending on the similarity and differences of the L1 and L2. Smolander et al., "L2 Vocabulary Acquisition," 76. Muñoz and colleagues found that linguistic proximity aided young L2 learners in vocabulary comprehension and acquisition. Carmen Muñoz, Teresa Cadierno, and Isabel Casas, "Different Starting Points for English Language Learning: A Comparative Study of Danish and Spanish Young Learners," *Language Learning* 68, no. 4 (2018): 1100.

cognates, and the similarities may benefit acquisition.[41] As cognates may facilitate vocabulary learning, the same level of acquisition may not be achieved, given the same amount of input, when acquiring a language with fewer cognates.[42]

Instrumentation

During the various phases, I administered the assessments, along with one staff of DSL trained in administering clinical assessments.[43] I was the only one to administer any Spanish language assessments.

Phase 1

Before beginning the intervention of Spanish classes, students were administered three categories of assessments: NVC, VSTM, and English vocabulary. Since one requirement for participation in the study was that students have no significant prior exposure to Spanish, no Spanish language pre-test was given. Based upon the following reasons, this battery of assessments served to develop a profile for those students participating in the case study, served as a predictor for Spanish vocabulary acquisition for all participants, and helped to answer the research questions.

First, since individuals with DS have a marked deficit in language, NVC is

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[41] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 55.

[42] Martin Willis and Yoshie Ohashi, "A Model of L2 Vocabulary Learning and Retention," *The Language Learning Journal* 40, no. 1 (2012): 127, 131, 133. Eva Lindgren and Carmen Muñoz found that cognate linguistic difference is a key predictor of receptive language acquisition. Eva Lindgren and Carmen Muñoz, "The Influence of Exposure, Parents, and Linguistic Distance on Young European Learners' Foreign Language Comprehension," *International Journal of Multilingualism* 10, no. 1 (2013): 105–29. However, Smolander and colleagues argue that the usefulness of cognates in acquiring vocabulary is limited. Smolander et al., "L2 Vocabulary Acquisition," 74. Caroline Floccia et al. found that phonological similarity is helpful for vocabulary production, while typological and morphological closeness contribute to vocabulary comprehension. Caroline Floccia et al., "Vocabulary of 2-Year-Olds Learning English and an Additional Language: Norms and Effects of Linguistic Distance: III: Analyses and Results for Study 1: Estimating the Effect of Linguistic Distance on Vocabulary Development," *Monographs of the Society for Research in Child Development* 83, no. 1 (2018): 60.

[43] The staff who helped administer assessments has a Masters in Counseling Psychology. She administered the KBIT-2 during the first two days of the camp, outside of the time of Spanish class.

typically used to measure cognitive ability in language acquisition studies of individuals with DS rather than verbal cognition.[44] Utilizing measurements of NVC gives a more accurate representation of the child's cognitive capacities than would an assessment which relies upon verbal abilities due to the deficits in language typically experienced by individuals with DS.[45] Such an approach ensures that lack of language development is not confused with deficits in cognition.[46] NVC has been shown to correlate with language development in children with DS and possibly with L2 acquisition in the TD population, and thus may serve as an important predictor of FL acquisition.[47]

Secondly, measurement of participants' English vocabulary provided a useful predictor of possible L2 acquisition and helped to develop a richer profile for those students participating in the case studies. Studies of L2 vocabulary acquisition often include an initial measurement of L1 vocabulary. At times this measurement is included to track L1 development through the course of a study.[48] Other times the relationship of L1 vocabulary to L2 acquisition may be under investigation, as L1 vocabulary levels

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[44] Chapman and Kay-Raining Bird, "Language Development," 167. See, for example, Ward, "Profiling the Language Abilities," 107; Cuskelly, Povey, and Jobling, "Trajectories of Development," 114; Bernadette Witecy and Martina Penke, "Language Comprehension in Children, Adolescents, and Adults with Down Syndrome," *RDD* 62 (2017): 186.

[45] Godfrey and Raitano Lee, "Memory Profiles," 3.

[46] Chapman and Kay-Raining Bird, "Language Development," 167.

[47] Chapman and Kay-Raining Bird, "Language Development," 168, 174. For correlation of NVC and L2 development in the TD population, see He Sun et al., "Individual Differences in Very Young Children's English Acquisition in China: Internal and External Factors," *Bilingualism: Language and Cognition* 19, no. 3 (2016): 560–61; Kristin Kersten et al., "Quality of L2 Input and Cognitive Skills Predict L2 Grammar Comprehension in Instructed SLA Independently," *Languages* 6, no. 3 (2021): 1–19; Heather Golberg, Johanne Paradis, and Martha Crago, "Lexical Acquisition over Time in Minority First Language Children Learning English as a Second Language," *Applied Psycholinguistics* 29, no. 1 (2008): 61.

[48] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language;" Peker and Regalla, "Making Exemption the Exception."

have been shown to correlate with L2 acquisition in TD populations.[49] In studies of sequential bilingualism and FL acquisition in children with DLD, measurements of L1 vocabulary can play an important role in research.[50] Additionally, gathering measurements of vocabulary abilities in the L1 and L2 is a common procedure in studies on bilingualism in individuals with DS.[51]

Next, VSTM is a weakness in individuals with DS and may correlate to L1 development.[52] Additionally, VSTM has been shown to correlate in TD populations with L2 acquisition.[53] Thus, VSTM may serve as a useful predictor for FL vocabulary

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[49] Richard L. Sparks, Jon Patton, and Julie Luebbers, "Individual Differences in L2 Achievement Mirror Individual Differences in L1 Skills and L2 Aptitude: Crosslinguistic Transfer of L1 to L2 Skills," *Foreign Language Annals* 52, no. 2 (2019): 255–83; Vibeke Grøver, Joshua Lawrence, and Veslemøy Rydland, "Bilingual Preschool Children's Second-Language Vocabulary Development: The Role of First-Language Vocabulary Skills and Second-Language Talk Input," *International Journal of Bilingualism* 22, no. 2 (April 2018): 234–50; Larry Vandergrift and Susan Baker, "Learner Variables in Second Language Listening Comprehension: An Exploratory Path Analysis," *Language Learning* 65, no. 2 (2015): 407, 410; Nicolay and Poncelet, "Cognitive Abilities underlying Second-Language Vocabulary Acquisition," 664; Melissa Koenig and Amanda L. Woodward, "Toddlers Learn Words in a Foreign Language: The Role of Native Vocabulary Knowledge," *Journal of Child Language* 39, no. 2 (2012): 6–7; Sparks et al., "Long-Term Crosslinguistic Transfer," 222–24; Tong Li et al., "Longitudinal Predictors of Spelling and Reading Comprehension in Chinese as an L1 and English as an L2 in Hong Kong Chinese Children," *Journal of Educational Psychology* 104, no. 2 (2012): 295–99; C. Patrick Proctor et al., "The Intriguing Role of Spanish Language Vocabulary Knowledge in Predicting English Reading Comprehension," *Journal of Educational Psychology* 98, no. 1 (2006): 165–67.

[50] Inge Zoutenbier and Rob Zwitserlood, "Exploring the Relationship between Native Language Skills and Foreign Language Learning in Children with Developmental Language Disorders," *Clinical Linguistics & Phonetics* (February 2019): 1–13; Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language;" Ludo Verhoeven et al., "Assessment of Second Language Proficiency in Bilingual Children with Specific Language Impairment: A Clinical Perspective," *RDD* 32, no. 5 (2011): 1798–807.

[51] Ward, "Profiling the Language Abilities," 106; Feltmate and Bird, "Language Learning," 9; Dimitra Katsarou and Georgia Andreou, "Bilingualism in Down Syndrome: A Greek Study," *International Journal of Disability, Development and Education* 68, no. 3 (2021): 1–7; Trudeau et al., "Développement lexical chez les enfants," 392.

[52] Glynis Laws, "Contributions of Phonological Memory, Language Comprehension and Hearing to the Expressive Language of Adolescents and Young Adults with Down Syndrome," *Journal of Child Psychology and Psychiatry* 45, no. 6 (2004): 1090; Glynis Laws and Deborah Gunn, "Phonological Memory as a Predictor of Language Comprehension in Down Syndrome: A Five-Year Follow-up Study," *Journal of Child Psychology and Psychiatry* 45, no. 2 (2004): 333–35.

[53] Unsworth et al., "An Investigation of Factors," 543; Nicolay and Poncelet, "Cognitive

acquisition in children with DS. Due to a lack of research among children with DS and populations with other memory impairments this claim has yet to be substantiated.[54] Analysis based upon the data collected in this study helps fill this gap in the research. VSTM is often measured by nonword repetition tasks, which were administered in this study.[55]

Finally, this study investigated the impact of participation in a six-week FL class on L1 vocabulary development in children with DS. For this purpose, a control group of children with DS not participating in the Spanish class was administered pre-intervention measurements of NVC and English vocabulary.[56] Pre-intervention measurements of English vocabulary were compared to post-intervention measurements of English vocabulary to measure any change in L1 vocabulary. Additionally, analysis of the data gathered investigated the correlation between L1 vocabulary and L2 vocabulary acquisition in the FL context for children with DS.

KBIT-2. The Visual Matrices of the *Kaufman Brief Intelligence Test*, *Second Edition* (KBIT-2) was utilized to measure the NVC of all intervention participants.[57] The

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Abilities," 664–67; Pascale M. J. Engel de Abreu and Susan E. Gathercole, "Executive and Phonological Processes in Second-Language Acquisition," *Journal of Educational Psychology* 104, no. 4 (2012): 974–86; Elvira V. Masoura and Susan E. Gathercole, "Contrasting Contributions of Phonological Short-Term Memory and Long-Term Knowledge to Vocabulary Learning in a Foreign Language," *Memory* 13, no. 3–4 (2005): 422–29; Josje Verhagen and Paul Leseman, "How do Verbal Short-Term Memory and Working Memory Relate to the Acquisition of Vocabulary and Grammar? A Comparison between First and Second Language Learners," *Journal of Experimental Child Psychology* 141 (2016): 65–82.

[54] Verhagen and Leseman, "Verbal Short-Term Memory and Working Memory," 79.

[55] Tessel Boerma et al., "A Quasi-Universal Nonword Repetition Task as a Diagnostic Tool for Bilingual Children Learning Dutch as a Second Language," *JSLHR* 58, no. 6 (2015): 1748; Leif Michael French, *Phonological Working Memory and Second Language Acquisition: A Developmental Study of Francophone Children Learning English in Quebec* (Lewiston, NY: Edwin Mellen Press, 2006), 33.

[56] In the final analysis, the English vocabulary data of the control group was not used as the post-intervention control group participants were too small in number to serve as a valid control group.

[57] Alan S. Kaufman and Nadeen L. Kaufman, *K-BIT 2: Kaufman Brief Intelligence Test*, 2nd ed. (Circle Pines, MN: Pearson, 2004).

Visual Matrices sub-test of the KBIT-2 has been used to determine NVC in studies of children with DS, including studies of language acquisition and/or bilingualism.[58] In the development of a cognitive test battery designed specifically for individuals with DS, the KBIT-2 was one "neuropsychological measure" used "to establish concurrent validity of the test battery measures."[59] The Visual Matrices of the KBIT-2 provides a raw score, standard score, percentile rank, descriptive category, and age-equivalent (MA).

The Visual Matrices of the KBIT-2 tests an individual's ability to recognize and establish patterns or analogies of visual stimuli. Initially, the participant is presented with a single picture and must choose from a selection of five pictures which one best corresponds to the single picture. As the items progressively increase in complexity, the participant is presented with a group of pictures and must choose from a selection of six pictures which one completes the analogy or pattern represented by the group of pictures. Starting point is usually based on age and a basal is established with three consecutive correct answers. The test is terminated after four consecutive incorrect answers. Participants receive one point for every item answered correctly, including all items prior to their basal. The Visual Matrices require less than twenty minutes to administer. The KBIT-2 was administered in accordance with the manual guidelines, with one exception: students with DS began on item one rather than their age-related started point to avoid the need to drop back to an earlier starting point or unnecessary frustration for the participant.[60] The Visual Matrices were administered to all intervention participants as well as L1 control group participants.

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[58] Deborah J. Fidler, David E. Most, and Mark M. Guiberson, "Neuropsychological Correlates of Word Identification in Down Syndrome," *RDD* 26, no. 5 (2005): 490; Jennifer Breslin et al., "Obstructive Sleep Apnea Syndrome and Cognition in Down Syndrome," *Developmental Medicine & Child Neurology* 56, no. 7 (2014): 662; Ward and Sanoudaki, "Language Profiles," 6.

[59] Jamie O. Edgin et al., "Development and Validation of the Arizona Cognitive Test Battery for Down Syndrome," *Journal of Neurodevelopmental Disorders* 2, no. 3 (2010): 160.

[60] Alan S. Kaufman and Nadeen L. Kaufman, *Kaufman Brief Intelligence Test Manual*, 2nd ed.

PPVT-4. The *Peabody Picture Vocabulary Test,* Fourth Edition (PPVT-4) is a widely used measure of English receptive vocabulary in studies of individuals with DS.[61] Normed on 3,540 English-proficient individuals ranging from two years and six months to ninety years residing in the United States, it received reliability coefficients of higher than .90 for all age groups in the TD population.[62] It has also been shown to be a valid instrument for measurement of receptive vocabulary in individuals with DS.[63] The test consists of 228 items, divided into nineteen sets of twelve items each, with each item (page) containing four brightly-colored pictures of verbs, adjectives, or nouns. In this individually administered assessment, the examiner says a word and the examinee indicates which picture represents said word either nonverbally by pointing to the picture or verbally by stating the number which corresponds to the picture. Items progressively increase in difficulty, beginning with more frequent words, progressing to less frequent words. Starting point for the assessment depends on the examinee's age, with a basal of no more than one incorrect item in a set. If more than one item is missed in a set, the examiner must regress to the previous set until a basal is established. Upon establishing a

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(Circle Pines, MN: Pearson, 2004), 11.

[61] Lloyd M. Dunn and Douglass M. Dunn, *Peabody Picture Vocabulary Test*, 4th ed. (Minneapolis: NCS Pearson, 2007). See, for example, Kay-Raining Bird et al., "The Language Abilities of Bilingual Children;" Robin S. Chapman, Linda J. Hesketh, and Doris J. Kistler, "Predicting Longitudinal Change in Language Production and Comprehension in Individuals with Down Syndrome: Hierarchical Linear Modeling," *JSLHR* 45, no.5 (2002): 902–15; Susan J. Loveall et al., "Receptive Vocabulary Analysis in Down Syndrome," *RDD* 55 (2016): 1–23; Sari Alony and Alex Kozulin, "Dynamic Assessment of Receptive Language in Children with Down Syndrome," *Advances in Speech Language Pathology* 9, no. 4 (2007): 323–31.

[62] Lloyd M. Dunn and Douglass M. Dunn, *Peabody Picture Vocabulary Test Manual*, 4th ed. (Minneapolis: NCS Pearson, 2007), 32; Community-University Partnership for the Study of Children, Youth, and Families, "Review of the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4)," Edmonton, Alberta, Canada, 2011, 3. https://www.ualberta.ca/community-university-partnership/media-library/community-university-partnership/resources/tools---assessment/ppvt-4may-2012.pdf.

[63] Neneng Tati Sumiati, Frieda Mangunsong, and Guritnaningsih Guritnaningsih, "Validitas Konstruk Peabody Picture Vocabulary Test-Edisi Keempat (PPVT-4) pada Anak dengan Sindrom Down," *Psikologika: Jurnal Pemikiran dan Penelitian Psikologi* 26, no. 1 (2021): 169–94.

basal, the exam continues until the examinee misses more than seven items in a single set. The assessment generally takes between ten to fifteen minutes to complete.

The PPVT-4 was administered according to the manual guidelines with one exception: starting point for participants with DS. Since MA for individuals with DS typically lags behind their CA, using item one as a basal eliminated the possibility of needing to return to a prior starting point and reduce the likelihood of participants with DS experiencing feelings of failure from the start of the assessment.[64] The PPVT-4 was administered to all intervention participants as well as L1 control group participants.

EVT-2. The *Expressive Vocabulary Test, Second Edition* (EVT-2) is the co-normed companion of the PPVT-4 and measures an individual's ability to name single-word nouns, verbs, or adjectives.[65] Since the EVT-2 and the PPVT-4 were normed on the same population, a "meaningful comparison of receptive and expressive vocabulary abilities" can be made.[66] The EVT-2 is often used in studies of children with DS.[67]

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[64] For precedent see Glynis Laws et al., "Receptive Vocabulary and Semantic Knowledge in Children with SLI and Children with Down Syndrome," *Child Neuropsychology* 21, no. 4 (2015): 496. I recognize that this may have resulted in a long testing time for more capable students. However, as I had no previous information about the capabilities of the participants, I had no way of knowing which students would have benefitted from a different starting point. Additionally, post-test starting points were adjusted based off of pre-test results in order to reduce testing time in post-test administration.

[65] Kathleen T. Williams, *The Expressive Vocabulary Test*, 2nd ed. (Minneapolis: NCS Pearson, 2007).

[66] Christopher Jarrold, Annabel S. C. Thorn, and Emma Stephens, "The Relationships among Verbal Short-Term Memory, Phonological Awareness, and New Word Learning: Evidence from Typical Development and Down Syndrome," *Journal of Experimental Child Psychology* 102, no. 2 (2009): 204; Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 60.

[67] See, for example, Rachel F. Hick, Nicola Botting, and Gina Conti-Ramsden, "Short-Term Memory and Vocabulary Development in Children with Down Syndrome and Children with Specific Language Impairment," *Developmental Medicine and Child Neurology* 47, no. 8 (2005): 532–38. Jarrold, Thorn, and Stephens, "Relationships among Verbal Short-term Memory;" Emily K. Schworer, Emily K. Hoffman, and Anna J. Esbensen, "Psychometric Evaluation of Social Cognition and Behavior Measures in Children and Adolescents with Down Syndrome," *Brain Sciences* 11, no. 7 (2021): 3; Lauren B. Adamson et al., "Joint Engagement and the Emergence of Language in Children with Autism and Down Syndrome," *JADD* 39, no. 1 (2009): 6. More variation is found in the literature regarding the types of assessments used to measure expressive vocabulary in children with DS as opposed to receptive, since expressive

Though it has not yet been validated for children with DS, it has been deemed an appropriate measure of expressive vocabulary for individuals with DS.[68] The EVT-2 is an individually administered test in which the administrator shows the examinee a picture and prompts the examinee to give a one-word description of the picture or a one-word synonym. The assessment progresses in difficulty: initially the child is shown a picture and asked to name it. Difficulty increases when the child is presented with a picture and a spoken word, and the child is asked to provide a synonym. Starting point for the EVT-2 is based upon age and five consecutive correct items are required to establish a basal. The assessment is terminated when the examinee gives five consecutive incorrect answers. The EVT-2 takes ten to fifteen minutes to administer.

The EVT-2 was administered according to the manual guidelines with the following exception: students with DS did not begin at the age-related starting point but rather with the first item. Since MA of children with DS is typically below CA, this prevented the examiner from needing to return to a previous starting point. The EVT-2 was administered to all intervention participants as well as L1 control group participants.

Nonword repetition task. A nonword repetition task (NWRT) measures an individual's ability to correctly repeat nonwords of increasing length and serves as a measure of verbal (phonological) short-term memory.[69] NWRTs are often used in studies

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development is delayed children with DS. Thus, language assessments designed for preschool-aged children, or alternative assessments such as questionnaires for parental reporting or language samples are sometimes utilized. These alternative methods are especially prevalent in studies examining young children. See Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 191; Trudeau et al., "Développement lexical chez les enfants," 390; Danielle te Kaat-van den Os et al., "Expressive Vocabulary Development in Children with Down Syndrome: A Longitudinal Study," *Journal of Policy and Practice in Intellectual Disabilities* 14, no. 4 (2017): 313. However, since all participants are school age, the EVT was deemed appropriate.

[68] Anna J. Esbensen et al., "Outcome Measures for Clinical Trials in Down Syndrome," *American Journal on Intellectual and Developmental Disabilities* 122, no. 3 (2017): 6.

[69] Boerma et al., "A Quasi-Universal Nonword Repetition Task," 1748.

of children with DS, and have been found to be a reliable measure of phonological short-term memory in individuals with DS.[70] The NWRT used for this study was adapted from a quasi-universal NWRT developed by Shula Chiat which has been used in various studies of bilingualism and second language learners.[71] The version which was utilized for this study, adapted for English speakers, was shared with me by Elizabeth Kay-Raining Bird, leading scholar of bilingualism in children with DS. She and her colleagues modified and utilized this version for a study, currently in press.[72] In the NWRT used for this study, participants listen to a recording of someone saying a nonword, which they must repeat. Participants listen to sixteen words of increasing length, one at a time, and repeat each one immediately after they hear it. Items are recorded and played only once unless there is an interruption or distraction. Items are scored on the spot, as either correct or incorrect and are considered correct if all segments of the word are present and in the correct order. Answers are recorded by hand and audio recording of the participant responses is made to later confirm correct scoring. The NWRT was administered only to intervention participants and was administered according to instructions.[73]

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[70] Glynis Laws, "The Use of Nonword Repetition as a Test of Phonological Memory in Children with Down Syndrome," *Journal of Child Psychology & Psychiatry & Allied Disciplines* 39, no. 8 (1998): 1119–30.

[71] Shula Chiat, "Nonword Repetition," in *Methods for Assessing Multilingual Children: Disentangling Bilingualism from Language Impairment*, ed. Sharon Armon-Lotem, Jan de Jong, and Natalia Meir (Bristol, UK: Multilingual Matters, 2015), 125–50. For examples of studies which utilize this assessment for learners of a second language, see Boerma et al., "A Quasi-Universal Nonword Repetition Task," 1747–60; Enni Vaahtoranta et al., "Language Exposure and Phonological Short-Term Memory as Predictors of Majority Language Vocabulary and Phonological Awareness in Dual Language Learning," *Bilingualism: Language and Cognition* 24, no. 2 (2021): 319–32.

[72] A. Sutton et al., "Developmental Patterns of Non-Word Repetition by Monolingual and Bilingual School-Aged Children," *Journal of Language and Communication Disorders*, Article in Press (2022): 1–23.

[73] In the scoring of the NWRT, consistent errors of the participants (i.e., consistent phonological substitutions made in conversation) were not taken into account.

Phase 2

No assessments were administered to intervention participants during phase 2 of the study for the purpose of data collection. Rather, instrumentation was developed to assess the Spanish vocabulary acquisition of participants based on the content of the Spanish course. Two instruments were developed during phase 2: one to assess receptive lexical acquisition of Spanish and one to assess the expressive lexical acquisition of Spanish. As previously described, both assessments were based off of standardized assessments in format and administration but used vocabulary from the Spanish intervention curriculum for content. In line with the general trends of assessing receptive vocabulary, the assessment I developed for receptive lexical acquisition were "(tests) of word-picture matching" based off of one of the most commonly used standardized assessments of receptive vocabulary, the *Peabody Picture Vocabulary Test* (PPVT).[74] The same pattern was followed for the assessment which I developed for expressive lexical acquisition in which children must name a picture.[75]

Items for both assessments developed came from the stories, TPR, music, games, and classroom procedures used in the Spanish intervention. In order to be included, items had to be used in multiple or repeated contexts in the classroom curriculum, and able to be pictured by an illustration. Any vocabulary item included in the standardized Spanish assessments (EOWPVT-B and ROWPVT-B) were not included in the content-based assessments so that there was no overlap of items. All items are

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[74] Laws et al., "Receptive Vocabulary and Semantic Knowledge," 491. The *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (ROWPVT-B) is nearly identical to the PPVT in format and administration. Since the ROWPVT-B was the standardized test I used to assess Spanish receptive acquisition, I also modeled my assessment after the ROWPVT-B. Nicolay and Poncelet followed a similar pattern in their content-based L2 vocabulary assessments Nicolay and Poncelet, "Cognitive Abilities underlying Second-Language Vocabulary Acquisition," 661–62.

[75] Picture identification and naming are the most common ways of assessing vocabulary in children and are especially useful for non-literate populations, making them an ideal form of vocabulary assessment for children with DS. Ewa Haman, Magedalena Łuniewska, and Barbara Pomiechowska, "Designing Cross-Linguistic Lexical Tasks (CLTs) for Bilingual Preschool Children," in Armon-Lotem, de Jong, and Meir, *Methods for Assessing Multilingual Children*, 203–4.

hand-drawn black and white illustrations representing one word, action, noun, or attribute. I drew the pictures myself. The format and administration of these assessments are described in further detail in the phase 3 instrumentation section. The EVCBT pilot test form and the RVCBT pilot test form can be found in appendices twelve and thirteen, respectively.

After the initial development of the instrumentation, the assessments were piloted with two groups of elementary-aged students: a group of TD students (N=13) and a group of students with DS (N=5). Basic demographic information about the pilot test participants can be viewed in table A6 in appendix 19. The students who participated in the piloting of the Spanish vocabulary assessments were not participants in the intervention study, though one student with DS was also part of the L1 vocabulary control group. All children received parental permission to participate in the pilot test. The purpose of the pilot test was to establish that the drawings accurately represented the intended word/concept. Children that are native English speakers were given the assessments in English. Though these assessments were administered in Spanish in phase 3, the purpose of the pilot group was to establish that the drawings accurately represented the intended word/concept, not to test Spanish language skills. This could be accomplished in English or Spanish. The participant whose L1 was Spanish was given the assessment in Spanish.[76] Testing the assessments in Spanish on L2 learners of Spanish would not be effective for the purposes of the pilot testing, since they may not have the necessary vocabulary to successfully complete the assessments and thus establish whether or not the drawings accurately represent the intended word/concept.

Any item which was not recognized one hundred percent of the time by the TD group as representing the word spoken was not included in the final version of the

[76] One child with DS whose native language was Spanish participated in the pilot test. He was nonverbal and thus only was only administered the receptive vocabulary pilot test.

receptive assessment. Any drawing which did not solicit the correct spoken word or its synonym one hundred percent of the time by the TD group was not included in the final expressive assessment. Because children with DS lag behind their TD peers in their vocabulary development it could not be assumed that they would correctly identify or name every item in the assessment, especially considering it could not be assured that they had previously been exposed to the words in the assessment. However, their participation in the pilot testing was valuable to ensure that the test was suitable for their abilities. If an item was missed by participants in the group of children with DS fifty percent of the time or more, it was eliminated from the final assessment.

The final number of items in each assessment depended upon curriculum content and reliability of drawings as indicated by the pilot test. All drawings included in the pilot test which did not meet the stipulated requirements were disregarded for the final version of the assessments. Additionally, items which were included in the pilot test but by the end of the intervention were not sufficiently represented in the curriculum through multiple or repeated contexts were excluded from the final version of the assessments. After exclusion of items based upon stipulated requirements of the pilot test and frequency of use in the curriculum, the final expressive assessment consisted of thirty-five items and the final receptive assessment consisted of forty-five items. The final versions of the EVCBT and RVCBT assessment forms along with a sample item of each can be found in appendices fourteen through seventeen.

Phase 3

In phase 3 of the study, students were administered two tests to assess English vocabulary and four tests to assess Spanish vocabulary.

PPVT-4. Students were administered a parallel version (Form B) the PPVT-4 as a post-intervention measurement of English receptive vocabulary. This parallel version is an equivalent form of the PPVT-4 with a distinct set of vocabulary items. It allowed for a comparison of L1 receptive vocabulary levels between the pre-intervention and post-intervention assessments while ensuring that any increase in vocabulary score was not due to previous exposure or “learning” the test. PPVT-4 test items were normed on a sample of 3,540 individuals residing in the United States and proficient in English ranging from ages two years and six months to ninety years and older, and 533 examinees were tested on both forms A and B.[77] When tested on measures of alternate-form reliability, the PPVT-4 received reliability coefficients between .87 and .93, considered to be “very reliable.”[78] The administration of the post-intervention PPVT-4 followed the same guidelines used in the administration of the pre-test, with one major exception: starting point. In the pre-intervention assessment, all participants began at item one. Based upon the results of the pre-intervention assessment, a basal was established for every participant. This basal was used in the post-intervention as the starting point to reduce the amount of time required to administer the assessment and to avoid administration of unnecessary items. The PPVT-4 Form B was administered to all intervention participants as well as the L1 control group participants.

EVT-2. Students were administered a parallel version (Form B) the EVT-2 as a post-intervention measurement of English expressive vocabulary. This parallel version is an equivalent form of the EVT-2 with a distinct set of vocabulary items. It allowed for a comparison of L1 expressive vocabulary levels between the pre-intervention and post-intervention assessments while ensuring that any increase in vocabulary score was not due to previous exposure or “learning” the test. EVT-2 items were normed on a sample of 3,450 individuals residing in the United States and proficient in English, ranging from ages two years six months to ninety years and older, with 507 examinees receiving both

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[77] Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 32, 45.

[78] Community-University Partnership for the Study of Children, Youth, and Families, “Review of the Peabody Picture Vocabulary Test,” 3.

forms A and B.[79] When tested on measures of alternate-form reliability, the EVT-2 received reliability coefficients between .83 and .91, considered to be “very reliable.”[80] The administration of the post-intervention EVT-2 followed the same guidelines used in the administration of the pre-test, with one major exception: starting point. Based upon the results of the pre-intervention assessment, a basal was established for every participant. This basal was used in the post-intervention as the starting point to reduce the amount of time required to administer the assessment and to avoid administration of unnecessary items. The EVT-2 Form B was administered to all intervention participants as well as the L1 control group participants.

ROWPVT-B. The *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (ROWPVT-B) is the standardized assessment which was used to measure receptive Spanish vocabulary acquisition of all intervention participants.[81] The ROWPVT-B, and its counterpart, the *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (EPWPVT-B) have been used in studies of bilingualism and FL acquisition, including for individuals with special needs and DLD.[82] The ROWPVT-B

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[79] Williams, *The Expressive Vocabulary Test Manual*, 44, 57.

[80] Community-University Partnership for the Study of Children, Youth, and Families, “Review of the Expressive Vocabulary Test, Second Edition (EVT-2),” Edmonton, Alberta, Canada, 2011, 3. https://www.ualberta.ca/community-university-partnership/media-library/community-university-partnership/resources/tools---assessment/evt-2--may-2012.pdf.

[81] Nancy A. Martin, *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (Novato, CA: Academic Therapy, 2013).

[82] Studies investigating bilingualism and individuals with DLD employing both the ROWPVT-B and the EOWPVT-B include: Giang Pham, Kerry Danahy Ebert, and Kathryn Kohnert, “Bilingual Children with Primary Language Impairment: 3 Months after Treatment,” *International Journal of Language and Communication Disorders* 50, no. 1 (2015):1–19; Kerry Danahy Ebert, Jill Rentmeester-Disher, and Kathryn Kohnert, “Nonlinguistic Cognitive Treatment for Bilingual Children with Primary Language Impairment,” *Clinical Linguistics & Phonetics* 26, no. 6 (2012):1–22; The original English versions were used in the study of children with special needs in the FL classroom to assess their L1. Peker and Regalla, “Making Exemption the Exception,” 81. The Finnish versions were used in a study for L2 acquisition in children with DLD. Smolander et al., “L2 Vocabulary Acquisition,” 78. Studies which employ only the EOWPVT-B and investigate bilingualism and individuals with DLD include: Christine E.

was normed on 1,260 bilingual Spanish/English speaking individuals residing in the United States ranging from two to seventy-plus years old and measures an individual's ability to correctly identify spoken words for objects, actions, or concepts in Spanish or English.[83] The ROWPVT-B has a median reliability measure of 0.95 across all ages and content validity of .60 when standard scores of the second edition are compared to the first.[84]

The assessment includes 180 brightly colored test items. Each item is presented on a page with three other items. The examiner says a word in Spanish or English and the examinee must indicate verbally or nonverbally the picture which represents the stated word. Starting point is based on age and a basal is established after eight consecutive correct answers. If the examinee fails to establish a basal at the corresponding age-based starting point, the examiner must fall back to the previous age-based starting point until a basal is established. The test continues until a ceiling of four incorrect responses within six items is reached and takes approximately fifteen to twenty-five minutes to administer.[85]

The ROWPVT-B was administered according to the manual guidelines with the following exceptions: basal, ceiling, and language of administration. First, the assessment did not begin based on the age-indicated starting point, but rather, all participants began from the first item. The ROWPVT-B was normed on bilingual individuals, and as incipient L2 learners with minimal language exposure, participants

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Fiestas et al., "Spanish Language and Literacy Intervention for Bilingual Children at Risk for Developmental Language Disorder: A Pilot Study," *Topics in Language Disorders* 41, no. 4 (2021): 309–21; Stephanie M. Grasso et al., "Cross-Linguistic Cognate Production in Spanish–English Bilingual Children with and without Specific Language Impairment," *JSLHR* 61, no. 3 (2018): 619–33.

[83] Martin, *Receptive One Word*, 5.

[84] Martin, *Receptive One Word*, 51, 57.

[85] Martin, *Receptive One Word*, 23–25.

likely would not have been able to establish a basal at the age-related starting point. Thus, the first item was automatically considered the basal for all participants. Second, the assessment continued beyond the ceiling of six consecutive incorrect responses and continued through item number thirty-four for all participants. As novice language learners, participants reached a ceiling very quickly. Extending beyond the ceiling allowed participants the opportunity to demonstrate their knowledge more fully. Item number thirty-four was chosen as it clearly marks the end of a section and includes items which participants were likely to be exposed to during the course of the intervention. Items markedly increase in difficulty after item number thirty-four, and it was highly unlikely that any participant would correctly identify any item after this point based on their knowledge. If any participant still had not reached the ceiling at item number thirty-four, the assessment would have continued until a ceiling was reached. However, all participants reached a ceiling before item number thirty-four. Finally, items were stated by the examiner only in Spanish. The ROWPVT-B is intended to measure bilinguals' collective vocabulary in Spanish and English. One method of administration is to state a word in Spanish, and if the examinee cannot identify it in Spanish, to state the word in English. Since the purpose of the ROWPVT-B in this study was to assess the Spanish acquisition of participants, items were stated exclusively in Spanish.

EOWPVT-B. The *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (EOWPVT-B) is the standardized assessment which was used to measure expressive Spanish vocabulary acquisition of all intervention participants.[86] It was normed on the same group of individuals as its counterpart ROWPVT-B, and thus serves as an accurate comparison. The EOWPVT-B has median reliability measure of 0.95 across all ages and content validity of .67 when standard scores of the second edition

[86] Nancy A. Martin, *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (Novato, CA: Academic Therapy, 2013).

are compared to the first.[87] The EOWPVT-B consists of 180 items and tests an individual's ability to name a word, object, action, or concept in English or Spanish. The examinee is presented with a colored picture and must verbally name the picture. Starting point is based on age and a basal is established with eight consecutive correct answers. If the examinee fails to establish a basal at the age-related starting point, the examiner must return to the previous starting point until a basal is established. Items increase in difficulty, and the test continues until a ceiling of six consecutive incorrect responses is reached.[88] The EOWPVT-B takes between fifteen and twenty-five minutes to administer.

EOWPVT-B was administered according to the manual guidelines with the following exceptions: basal, ceiling, and acceptable response language. First, the basal for all participants was the first item. Since students were incipient L2 learners and the EOWPVT-2 was normed on a bilingual population, participants were not likely to be able to establish a basal of eight consecutive correct answers at their age-related starting point. Thus, all participants began with item number one. Second, the EOWPVT-B was administered beyond the participants' ceiling through item number thirty-four. Item number thirty-four was chosen as it clearly marks the end of a section and includes items which participants were likely to have been exposed to during the intervention. Items markedly increase in difficulty after item number thirty-four, and it was highly unlikely that any participant would correctly name any item after this point. If any participant still had not reached the ceiling at item number thirty-four, the assessment would have continued until a ceiling was reached. However, this was not the case for any participant. Finally, correct answers were only accepted in Spanish. Since the EOWPVT-B is intended to measure bilinguals' collective vocabulary in Spanish and English, answers are generally accepted in English or Spanish. However, in this study the EOWPVT-B

[87] Martin, *Expressive One Word*, 59, 65.

[88] Martin, *Expressive One Word*, 23–25.

was intended to measure Spanish vocabulary and thus credit was only received for correct answers in Spanish.

RVCBT. The receptive vocabulary content-based test (RVCBT) is the instrument which was developed in phase 2 to measure receptive acquisition of Spanish vocabulary from the intervention curriculum. The RVCBT assessed a participant's ability to recognize a spoken word in Spanish. The RVCBT was modeled after the ROWPVT-B in format and administration but assessed vocabulary taken directly from the curriculum used in the Spanish class intervention. The RVCBT consisted of forty-five hand-drawn black and white illustrations each representing one word, action, noun, or attribute. Each item in the RVCBT was presented to the participant on a sheet of paper along with three foils. The examiner said the item in Spanish and the participant was instructed to verbally or nonverbally indicate which drawing represented the stated word.

Unlike the ROWPVT-B, the RVCBT did not progressively increase in difficulty. Items in the RVCBT were not rated for difficulty but were included in the test if the students were consistently exposed to the word in class and it met the requirements of the pilot test. All participants began on item one and took the entirety of the test; there was no basal, ceiling, or age-related starting point. The test was expected to take no more than ten minutes to administer.[89]

EVCBT. The expressive vocabulary content-based test (EVCBT) is the instrumentation which was developed in phase 2 to measure expressive acquisition of Spanish vocabulary from the intervention curriculum. The EVCBT was modeled after the EOWPVT-B in format and administration but assessed vocabulary taken directly from the curriculum used in the Spanish class intervention. The EVCBT assessed a

[89] Due to the difficulty of some students to concentrate, the test took longer for some participants.

participant's ability to verbally name in Spanish a word, action, noun, or attribute represented by a hand-drawn black and white illustration. The examiner presented the participant with a picture and the participant was instructed to name the item in Spanish.

Unlike the EOWPVT-B, the EVCBT did not progressively increase in difficulty. Items in the EVCBT were not rated for difficulty but were included in the test if the students were consistently exposed to the word in class and it met the requirements of the pilot test. All participants began on item one and took the entirety of the test; there was no basal, ceiling, or age-related starting point. The test consisted of thirty-five items and was expected to take no more than ten minutes to administer.[90]

Procedures

The research design was implemented through the following steps: (1) recruit students and confirm qualifications to participate in the study, (2) orient assistants, (3) administer pre-tests, (4) implement intervention and gather data for the case studies, (5) develop instrumentation, recruit participants for the pilot test, and implement pilot test, (6) administer and score post-tests, gather surveys, and conduct interviews for case studies, (7) analyze the data of the pre- and post-tests, (8) evaluate findings, draw conclusions, and finalize case studies.

Recruit Study Participants

The research sample of children with DS was recruited through DSL. Several weeks before the start of the summer camp DSL sent an email with a Google Form survey to inform parents of the opportunity for their child to participate in the study and to request that they fill out a survey of interest. Very little feedback was received from the initial emails. Upon full ethics approval, follow up emails were sent which included an informational video that I made to give parents more information about the study as

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[90] Due to difficulty to concentrating, the assessment took longer for some participants.

well as a Google Form through which parents could indicate whether or not they desired for their child to participate in the study. After minimal feedback was received from the follow up emails, I began to personally call from DSL the parents of students participating in the camp for the full six weeks. The majority of parents whom I contacted by phone were willing for their child to participate in the study.

In addition to recruiting intervention participants, I recruited children with DS for the L1 control group as well as children with DS and TD children for the pilot vocabulary test. Recruitment for the L1 control group was primarily through contacts given me from DSL. They provided me with names and numbers of the parents of elementary-aged students with DS whom they thought may be willing for their child to participate in the control group. I called these individuals from DSL and experienced some success in connecting with the contacts I was given. Contacts at local churches and homeschool communities were used to recruit students for the pilot vocabulary test. I made posts on various Facebook pages and multiple emails were sent to members of my church for this purpose.

Parents of intervention participants filled out an Agreement to Participate form (consent form), as well as a questionnaire with background information (both participant and parental). Parents of students with DS confirmed a diagnosis of DS from a medical professional for their child. Additionally, parents of all intervention participants confirmed that their child met the criterion of normal hearing to moderate hearing loss after correction and indicated whether or not their child had been diagnosed with autism spectrum disorder or suffered a traumatic brain injury, both of which can affect language learning. Absence of a previous traumatic brain injury was a requirement of inclusion, and the data of those participants with a dual diagnosis of ASD was analyzed separately from participants with DS only.

Upon agreement to participate in the class, parents were informed of the opportunity for their child to participate in a case study through their participation in the

Spanish intervention. They were provided with an information sheet which outlines what would be required of them and their child for the child to participate in the case study, and those that agreed for their child to participate filled out an Agreement to Participate form specifically for the case study. This form included permission to be video recorded for the purposes of gathering data. Additionally, parents of students attending the class due to their participation in the summer camp at DSL but who did not take part in data collection filled out an Agreement to Participate form specifying their intent to participate in the class but not data collection. These parents were also given the option for their child to participate in an alternative activity during Spanish class, but all parents of students attending the camp chose for their child to participate in Spanish class. Parents of intervention participants as well as all students attending the class but not participating in the study were informed that their child may be video-recorded during the course of the study for data-gathering purposes, and parental permission was sought. Parents were given the opportunity to exempt their child from being recorded and informed that accommodations would be made so that their child would not be recorded, but all parents consented.[91]

Orient Assistants

Classroom teachers for the summer academic enrichment camp served as the assistants in Spanish class.[92] Before classes began, assistants underwent an orientation to prepare them for assisting in the Spanish classroom. This orientation provided information regarding individuals with DS, classroom curriculum and protocol, the role

[91] The recording was for purposes of the case studies, and any child not participating in the case study was only be recorded due to proximity to the child/children being recorded for the case studies. All Agreement to Participate forms and the Participant Background Information Form can be found in appendices 1 through 6.

[92] Due to their role as classroom teachers, the title "assistant" and "teacher" may be used interchangeably when referring to the classroom teachers who served as assistants during Spanish class.

of assistants in the FL classroom, and data gathering procedures for case studies. I led the orientation regarding specifics of the Spanish class, and assistants received an orientation on educating and working with children with DS from the staff at DSL as part of their training to serve as teachers at the camp.

First, the training provided by DSL provided a general overview of the developmental profile of children with DS, including physical, medical, cognitive, communicative, and behavioral elements. Additionally, teachers were equipped with appropriate teaching and behavioral intervention strategies to utilize with children with DS, such as the use of visuals, signs and gestures, verbal cueing such as “first, then,” scaffolding, and praise. Secondly, I gave assistants orientation to the type of curriculum to be used in the class, classroom protocol, and general expectations of student participation. Thirdly, teachers were oriented to their duties as assistants, guidelines for interaction with students with DS in the Spanish class, and specific strategies to support students with DS in the FL classroom. For example, assistants should not translate into English for students or force them to participate, but rather facilitate understanding and encourage and/or facilitate participation. Assistants could help facilitate understanding by modeling for students, using gestures, providing visual aids, or when necessary, use English.[93] Assistants were provided with visual supports to aid the students with DS, and during the orientation they were instructed on how to use these supports in class. Finally, assistants received an orientation to the journal prompts which they filled out to provide daily observations of the case study participants’ class participation and evidence of acquisition. The orientation took place at DSL the week before classes began.

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[93] Assistants were encouraged not to use English with students unless necessary, i.e., when other methods of facilitating understanding did not succeed, or for behavioral support. However, assistants were discouraged from translating for students, that is, providing the direct English translation for students when I was telling a story, giving instructions, etc., so that students could first have an opportunity to try and comprehend without translation.

Administer Pre-Tests

The two weeks before the intervention began all participants took the initial portion of the pre-intervention assessments, in the following order: PPVT-4, EVT-4, and NWRT. Tests were administered in a quiet location at DSL.[94] Children were tested individually, and parents were not in the room with the students during the time of the testing.[95] A few minutes were spent talking or playing with the student until they were comfortable and ready to take the tests. All assessments were given in one setting, with short breaks between assessments as needed. The initial battery of pre-tests administered together took approximately forty-five minutes to an hour to administer.

During the first or second day of the camp participants were administered the KBIT-2 by a qualified staff member of DSL. Students were removed from their class and sat at a table with the staff member in the hallway. The KBIT-2 took about ten minutes to administer. Finally, participants in the L1 control group were also administered a battery of tests during these two weeks in the following order: KBIT-2, PPVT-4, and EVT-4. However, with the difficulty experienced recruiting L1 control group participants, two L1 control group participants were administered the battery of assessments during the first or second week of the camp in their home. Results of the pre-intervention assessments can be found on table A2 in appendix 18.

Intervention Implementation

The intervention consisted of six weeks of Spanish classes in two three-week sessions, with a one week break in between. Classes met Monday through Friday for forty-five minutes from June 13 to July 1, and from July 11 to July 29. Classes were part

[94] Those assessments which took place on the weekends were held in a conference room at a local institution of higher learning.

[95] On one occasion a mother joined the child for a limited amount of time because the child needed extra support sustaining their attention to complete the assessments. However, the mother did not interfere with the child’s responses in any way.

of the curriculum of the academic summer camp held at DSL, and all students attending the camp attended Spanish class, even if they were not a part of the data collection for the study. Attendance was taken by the assistants so that class attendance could be examined as a variable which may correlate with language acquisition. At the conclusion of the intervention parents of all participants completed a short survey regarding outside exposure to Spanish during the course of the intervention.[96]

Throughout the six weeks of the Spanish intervention, observational data was collected for the students participating in the case studies. This data was collected daily through video recording, observation, and journaling. Classes were recorded with an iPhone and/or iPad. During each class one assistant was assigned to observe a student participating in a case study. The assistant would answer questions in the provided journal regarding the student's participation and evidence of acquisition during class and/or shortly after class. I also recorded my thoughts and observations after class either on my phone or on a document on my computer. After the first three weeks of class and again at the end of the course, assistants completed a survey regarding the case study participants' evidence of language acquisition and class participation. They also provided feedback in an interview at the end of the intervention. All interviews were conducted via FaceTime on an iPhone within a week of the course ending. Finally, parents provided feedback concerning their child's attitude and use of Spanish outside of the classroom through a survey after the end of the course.

Instrumentation Development

The RVCBT and the EVCBT were developed using vocabulary drawn from the intervention curriculum. Once an initial version was complete it was piloted on a group of TD elementary students and a group of elementary students with DS. Students

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[96] A copy of the survey can be found in appendix 11.

for the pilot testing were recruited through community contacts. Parents of all pilot testing participants filled out an Agreement to Participate form. Pilot testing took place in a quiet room in DSL or at another quiet location convenient for the participant. The pilot testing took between fifteen to thirty minutes. The final version of the RVCBT and the EVCBT were completed by the last week of the intervention so that students could be assessed shortly after the intervention was complete.

Administer Post-Tests

Upon completion of the Spanish class intervention, students were given a battery of tests in the following order: PPVT-4, EVT-2, EOWPVT-B, ROWPVT-B, EVCBT, and RVCBT. All testing took place within a week and a half of the last day of the intervention. Tests were administered in a quiet location at DSL or in a conference room at a local institution of higher education.[97] Children were tested individually, and parents were not able to be in the room with the students during the time of the testing.[98] All assessments but a few were given in one setting, with short breaks between assessments as needed.[99] English language assessments were administered first, followed by Spanish language assessments. It was approximated that the battery of post-tests should take approximately and hour and a half to complete. Participants in the L1 control group were also administered the PPVT-4 and EVT-2 during the two weeks immediately following the end of the intervention. Since some L1 control group participants were not administered their pre-intervention assessments until a week or two after the intervention

[97] A few of the assessments were administered in a quiet location in the child's home because they were unable to complete them in the allotted time or in the case of several L1 control group participants, parents preferred that I come to their home due to the difficulty of bringing their child to DSL.

[98] One student's mother joined him for a while because he needed assistance focusing his attention. However, she did not interfere with his answering of questions.

[99] It was intended that all students follow the same pattern and complete the assessments in one session. However, two students were unable to maintain their attention and could not complete the full battery of assessments in one session.

began, their post-intervention assessments were adjusted accordingly so that the time frame from pre- to post-intervention assessments was the same as that for intervention participants.

The Spanish language assessments were administered in the following order: EOWPVT-B, ROWPVT-B, EVCBT, and RVCBT. The expressive assessment for each set was administered first, as recommended by the EOWPVT-B manual, so that students were required to state the vocabulary before hearing it in the administration of the receptive assessments, thus ensuring that they could not draw from their recent exposure to correctly name an item.[100] Since students were likely to experience the most success on the RVCBT, it was administered last, leaving students with a sense of success and accomplishment.

Analyze Data

To answer research question 1, observational data from the various sources was gathered, reviewed, and compared. A statistician conducted the majority of the statistical analysis of the quantitative data collected using Microsoft Excel 2016 with the Analysis ToolPak Add-in. No statistical analysis was needed to answer research question 2 regarding evidence for L2 acquisition in the DS only group, as the raw data from the post-intervention Spanish vocabulary tests were sufficient to answer that question. However, two independent two-tailed *t*-tests were utilized to compare performance on the standardized assessments to performance on the curriculum-based assessments. Furthermore, to answer sub-question A, a modified *t*-test used to control for a small control group was utilized to compare each participant with a dual diagnosis to the DS only group.[101] An independent two-tailed *t*-test was conducted to answer research

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[100] Martin, *Expressive One Word*, 31.

[101] John R. Crawford, Paul H. Garthwaite, and Sara Porter, “Point and Interval Estimates of

question 3 to determine the difference between expressive and receptive L2 acquisition. Pearson product-moment *r*-correlation coefficients and one-tailed *p*-values were computed to answer research question 4 and determine the relationship between L2 acquisition and select variables. Finally, to answer research question 5, two independent two-tailed *t*-tests were conducted to compare performance on the pre- and post-intervention English vocabulary assessments. Additionally, the mean and standard deviation of the GSV (growth scale value) difference of the English vocabulary pre- and post-tests were calculated and compared to the measure of significance as provided in the test manuals.[102]

Evaluate Findings

I used results of the data and statistical analysis to draw conclusions to answer the research questions. Additionally, I compiled the qualitative and quantitative data on the multiple case study participants to describe the language acquisition and class participation of each participant. Strengths and weaknesses of the study were described and recommendations for practice and future studies were given.

Effect Sizes for the Case-controls Design in Neuropsychology: Rationale, Methods, Implementations, and Proposed Reporting Standards," *Cognitive Neuropsychology*, i*First* (2010): 1–16; J. R. Crawford and Paul H. Garthwaite, "Investigation of the Single Case in Neuropsychology: Confidence Limits on the Abnormality of Test Scores and Test Score Differences," *Neuropsychologia* 40, no. 8 (2002): 1196–208.

[102] Growth scale value "is an indicator of the absolute level of performance" and is "designed (to measure) change over time." Kathleen T. Williams, *The Expressive Vocabulary Test Manual*, 2nd ed. (Minneapolis: NCS Pearson, 2007), 221.

CHAPTER 4

ANALYSIS OF FINDINGS

The purpose of this study was to examine the participation of children with DS with and without a comorbid diagnosis of ASD in a six-week FL class and to measure the receptive and expressive lexical acquisition of Spanish as a FL in students with DS. To fulfill this purpose I utilized an exploratory mixed methods multiple case study design. This involved recruiting participants, administering pre-intervention assessments, teaching a six-week Spanish intervention to elementary-aged students with DS and recording student participation, developing and piloting Spanish vocabulary assessments, and administering post-intervention assessments.[1] The research questions explored two major categories: participation of students with DS in the FL classroom and the initial stages of L2 acquisition in children with DS. This chapter will present a brief summary of the compilation protocols followed by an analysis of the findings to answer the research questions. I used an alpha level of .05 for all statistical tests.

Compilation Protocols

Both quantitative and qualitative data was gathered for this exploratory mixed methods multiple case study research. I will briefly overview the data collection methodology for each phase and refer the reader to chapter 3 for an in-depth description.

Phase 1

Phase 1 consisted of recruiting intervention participants as well as participants

[1] As outlined in chapter 3, more steps than this were involved, but the steps listed here were the main steps in the study.

for the L1 control group and the pilot vocabulary test. Intervention participants and some L1 control group participants were recruited through DSL and pilot vocabulary test participants and remaining L1 control group participants were recruited through community contacts. Pre-intervention assessments were administered to intervention participants and L1 control group participants during the two weeks prior to the Spanish intervention, as well as the first two days of the intervention. Intervention participants were administered the KBIT-2, NWRT, PPVT-4, and EVT-4. L1 control group participants were administered the KBIT-2, PPVT-4, and EVT-4. Additionally, parents filled out a background information form (participant and parental) which provided important demographic information. Finally, data for the case studies was gathered via video recording, observation, journaling, and assistant surveys during the six-week Spanish intervention.

Phase 2

Phase 2 consisted of developing the RVCBT and the EVCBT based upon the curriculum of the Spanish intervention and modeled after standardized vocabulary assessments. Pilot tests were administered to TD children and children with DS and the protocols outlined in chapter 3 were followed to determine the final contents of the RVCBT and the EVCBT.

Phase 3

Phase 3 took place upon the completion of the Spanish intervention. Post-intervention assessments were administered to intervention participants and L1 control group participants. Intervention participants were administered the PPVT-4, EVT-2, EOWPVT-B, ROWPVT-B, EVCBT, and RVCBT within a week and a half of the completion of the Spanish intervention. L1 control group participants were administered the PPVT-4 and EVT-2 within a week and a half of the completion of the Spanish intervention or within a comparable time frame from their pre-intervention to post-intervention assessments as the intervention participants. Additionally, parents of all intervention participants filled out a brief survey regarding their student's out of class exposure to Spanish. Finally, data for the case studies was gathered via parental surveys, assistant surveys, and assistant interviews.

Synthesis of Data

Both qualitative and quantitative data were gathered in this study to answer the research questions. Qualitative data gathered primarily in phase 1, but also in phase 3, was used to form the case studies and answer research question 1. Quantitative data gathered in phase 3 was used to answer research questions 2 and 3. Next, quantitative and demographic data gathered in phases 1 and 3 were combined to answer research question 4. Finally, quantitative data gathered in phases 1 and 3 was used to answer research question 5. Due to the effect of ASD on language development and the small number of participants with ASD, research questions 1 and 2 (sub-question A) include data from the participants with DS only and participants with a dual diagnosis of ASD, whereas research questions 3 through 5 examine data from participants with DS only. An analysis of the findings is presented below beginning with a presentation of the case studies.

Research Question Synopsis

1. How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?
    a. How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?
    b. How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?
    c. What barriers exist to their participation in the foreign language classroom?
    d. What type of support do children with Down syndrome need to successfully participate in the foreign language classroom?

e. What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?

2. To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?

   a. How does the acquisition of second language vocabulary in a six-week foreign language classroom of children with a dual diagnosis of ASD differ from that of their peers with DS only?

3. Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?

4. Which select variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome?

5. Do L1 vocabulary levels of children with Down syndrome change over the course of a six-week FL class as measured by a standardized assessment?

Case Studies

The first research question and its sub-questions examine the participation of elementary aged students with DS with and without a dual diagnosis of ASD in the FL classroom. The primary means of answering this qualitative research question is through case studies, though some observational data from whole class participation is used as well. I will first present each case study, with special attention given in the description to addressing the sub-questions of research question 1. I will then synthesize and summarize the descriptive data from the case studies and observations from the classes to directly answer research question 1 and its sub-questions.

Case Study Participants

Five children with DS from the intervention participants were originally recruited to participate in a case study based upon class enrollment and cognitive and linguistic profiles. However, one of those five withdrew from the summer camp program after only a few days. Subsequently, another child was recruited in his place as she demonstrated exceptional engagement and comprehension the first few days of class, and I recognized the need to document her participation in-depth. Two of the five case study participants had a diagnosis of ASD, and at least one participant from each of the three classes participated in a case study. An overview of case study participant demographics is presented in table 1 below. All names used are pseudonyms. Case study participant language profiles with pre- and post-intervention English and Spanish language assessment results are presented in table A7 in appendix 20.

Table 1. Case study participant demographics

	Allen	Sammy	Grace	Rusty	Rosie
Age	7:5	9:6	9:7	11:6	12:0
Gender	Male	Male	Female	Male	Female
Grade Completed	1	2	2	4	5
SC Class	Lower	Middle	Middle	Upper	Upper
NVMA	<4:0	<4:0	<4:0	5:8	4:8
NVC Raw Score	9	4	3	18	13
Hearing Status	Normal	ML–NC	Normal	Normal	ML–NC
ASD diagnosis	No	Yes	Yes	No	No

NOTE: Age (years:months); SC = Summer camp; NVMA = Nonverbal mental age (years:months); NVC =Nonverbal cognition (out of 46); ML–NC = mild loss, no correction

Case Study 1: Allen

At the start of the Spanish intervention, Allen was seven years and five months old and had completed first grade. He had a developmental age of below four years old, yet his age-equivalent English vocabulary scores exceeded four years of age. Allen's receptive vocabulary age-equivalent was four years and seven months, and his expressive vocabulary age-equivalent was five years and two months. These results were surprising given that children with DS often score below MA-matched peers on measurements of language, and expressive language usually lags behind receptive. His post-intervention English vocabulary age-equivalent scores presented the same pattern of a higher expressive age-equivalent than receptive. Allen seemed to have unusually advanced language skills for a young child with DS and could express himself verbally better than most children in the camp, even those much older than himself. He could read quite well and would attempt to read almost any text that was in front of him.

Allen's affinity for reading was apparent in Spanish class. English captions would often appear automatically for many of the Spanish music videos which were played in class. When this was the case, Allen would often sing along in English by reading the captions. After I noticed this tendency, I began to change the captions to Spanish whenever possible and toward the end of the six weeks, Allen began to prefer the Spanish captions. At one point when the English captions popped up automatically, he began to yell, "Spanish! Spanish!" As soon as I changed the captions to Spanish, he was satisfied and stopped yelling.

Despite his unusually high language skills, Allen struggled behaviorally. Transitions from preferred activities to non-preferred activities were especially difficult for Allen and could often cause him to scream, cry, kick, hit, and sometimes even bite. Allen's teachers struggled with how to respond to these meltdowns and the easiest way to appease him and keep the meltdown from reoccurring was to give him a phone or tablet on which to watch videos. The behavioral difficulties that Allen experienced in Spanish class presented themselves in other contexts of the camp as well. His teachers noted that, no matter the topic or subject, if he was not interested, he would refuse to engage. One teacher commented, "If he didn't want to do it, he wasn't going to do it, and would ensure that no one got in his way."

Spanish class occurred directly after two preferred activities for Allen: lunchtime and videos. During the transition between lunch and Spanish Allen's class would often watch a video of some sort. Videos are a highly preferred activity for Allen, and the transition from lunchtime and video watching to Spanish class was often unbearable for Allen, resulting in a major meltdown. On many occasions when I entered the classroom Allen already had a tablet or phone in hand and was engaged in independently watching a video on the device. Once Allen had a device in his possession, he was very unlikely to attend to the activities of Spanish class, and though present in the classroom, was often almost completely disengaged from the lesson and the language. Occasionally, however, even with the device in hand, he would turn his attention to the Spanish lesson if a video he liked was playing.

At times Allen's meltdowns necessitated that he be removed from the classroom. His behavior was often extremely disruptive for the other students and at times potentially harmful to himself, other students, or teachers. A classroom teacher, camp support staff, or a behavioral interventionist would sometimes wait with him outside the classroom, take him for a walk, or bring him to the sensory room until he was able or willing to calmly join the class again. As a result of his behavioral challenges Allen received much less Spanish input than the other intervention participants, and his behavioral challenges were by far his greatest barrier to participation in class and thus language acquisition.

Allen's disengagement in Spanish class may have indicated a negative attitude toward Spanish. Sometimes when transitioning from lunch to Spanish he would express a negative attitude toward Spanish by yelling, "No Spanish!" and a meltdown would often ensue. The teachers noticed that his behavior began to decline every day after lunch and were unable to discern if this was an attempt to escape Spanish due to a true dislike toward the language and the class or the fact that he was being required to transition from a highly preferred activity to a less preferred activity. However, he was generally very positive in his interactions with me and once he was engaged in Spanish class seemed to enjoy it. His mother reported a positive attitude toward Spanish at home, noting that he had an increased desire to speak Spanish and would spontaneously recall words in Spanish at home without prompting. She also noted that he was more interested in watching videos and listening to music in Spanish and seemed proud of himself for his new skill. His mother also reported that they were once at a park playing when a family nearby did not speak English. Allen took the initiative and greeted them by saying, "*hola*" (hello), indicating a positive attitude toward Spanish and a willingness to use it in contexts outside of the classroom.

Allen's engagement in Spanish class was largely dependent upon his mood before class began and his ability to transition successfully, and fluctuated widely day to day. He was able to best engage in Spanish class when a successful transition was made before I entered the classroom and quiet music was playing on the screen (as opposed to a preferred video). If the transition was not made before I entered the room, he would likely not engage well in Spanish class. While his disengagement was often due to his possession of the iPad or iPhone, he would also demonstrate disengagement by crying, wandering around the room or playing with any object he could get his hands on. However, even when Allen seemed disengaged by watching a video on a personal device or was sitting in another part of the room seemingly refusing to participate, he would sometimes say words in Spanish or sing along to the song. Thus, it seems that even when he was not participating with the other students in the activities of the class, his mind may have been at least partially engaged or attuned to the language. Sometimes he would become interested in a song or activity and on his own initiative leave the device in favor of the Spanish activity, at which time a teacher would put away the device so that he could continue to participate in class undistracted. However, if a teacher tried to take away the device against his will, he would have difficulty regulating his emotions and a meltdown would ensue.

Allen was most engaged when a preferred music video was playing, especially if he was able to choose the video. To facilitate him choosing which video we would watch next I would put a list of the song titles on the screen, and he would choose which song he wanted to listen to. By the end of the six weeks, he was able to read independently several of the song titles in Spanish, for example, *Los animales* (The Animals). He would also sometimes express which song he wanted without the help of the list by saying the name of the song or a word related to the song. For example, he might express that he wanted to watch the *Camina con Cosmo* (Walk with Cosmo) by saying a word or phrase from the song such as *corre* (run) or *con Cosmo* (with Cosmo). Allen would demonstrate his engagement by sitting and watching the video intently or by dancing and acting out the motions to the music and often singing along. Conversely, he especially struggled to participate if he was not allowed to choose the activity or if he had to wait and give someone else a turn to participate in an activity or choose a song. Allen occasionally enjoyed interactive activities such as throwing the dice and counting in Spanish, but this fluctuated widely from day to day, and if he was not interested in the activity he could resort to some kind of destructive behavior.

Allen was able to participate independently in all of the activities in Spanish class, but often chose not to participate and thus often needed support to stay involved in non-preferred activities. One teacher commented, “I think he could understand almost anything that you put in front of him, it’s just if he’s willing to or not.” Allen demonstrated his understanding of the language by acting out the verbs that were spoken or in a song, such as *duerme* (sleeps), *corre* (runs), or *salta* (jumps). He used spoken language to express his desires, likes, and dislikes. From the first day Allen was making an effort to speak in Spanish. On the first day of class without prompting he said the words, *sí* (yes), *siéntate* (sit), and *minuto* (minute). By the middle of the six-week course he was saying a variety of words in Spanish class such as numbers, body parts, colors, and action verbs and by the end of the six weeks was also saying the names of various animals and other descriptive and social words such as *rápido* (fast) and *gracias* (thank you).

Sometimes Allen was merely repeating the words that he heard but other times he was using the language to communicate. For example, he would sometimes say the words *corre* (runs), *salta* (jumps), or *baila* (dance) if he wanted me or someone else to do them. Other times he would say the word and act it out himself and would get very excited doing so. Allen also used Spanish to express when he did not want to participate in activity or be compliant with instructions. For instance, when instructed to sit in a chair, and given the option of *rojo* (red) or *azul* (blue) he said, "*rojo*, uh-uh" and "*azul*, no, no, no, no, no," and subsequently refused to sit in a chair. He also used Spanish to express when he did not want the class to engage in a particular activity. For example, when I announced that we were going to sing *los colores* (the colors) and Allen did not want to sing that song he exclaimed, "no, no, *los colores,* no *los colores*!"

Allen demonstrated little evidence of non-comprehension of the Spanish being used in class when he was engaged in the lesson. The only times Allen seemed to show evidence of non-comprehension of Spanish was when asked an open-ended question without sufficient scaffolding. For example, at times when the list of songs was on the screen I might ask him, "*¿Qué quieres?*" (What do you want?) or "*¿Cuál canción quieres?*" (Which song do you want?). Though at times he would indicate which song he wanted in response to these questions, other times he would simply look at the screen and not respond. However, when given two specific choices or when provided with other support such as me pointing to the screen, he would generally respond with the song that he wanted to listen to.

Another challenge faced by Allen which may have negatively affected his participation in Spanish class and language acquisition was the discrepancy between his developmental level and that of the other students in his class. While quantitative data is not available for all of the students in his class, Allen was more advanced than the other students in his class cognitively, linguistically, and socially. Though Allen was one of the most verbally expressive students in the entire camp, all of the other children in his class were either nonverbal or spoke in one- or two-word utterances. Multiple students in his class had either been diagnosed with autism or were in the process of being screened for autism, and with the exception of one other student in the class, the majority of the students preferred to play independently and did not have the social skills to interact constructively with other children.[2]

Due to the multiple severe disabilities experienced by the majority of the students in Allen's class, Spanish lessons in his class differed from the other two classes. Most notably, stories were not part of the curriculum in Allen's class as the students could not focus their attention on a story for even one minute, no matter how it was presented. Capturing the attention of all of the students in Allen's class with the same activity at the same time was almost impossible, though music videos were the most successful in holding the attention of the majority of the students at any given time. As a result of the absence of stories and the related activities, the variety of vocabulary to which Allen and his classmates were exposed was less than that of the students in the other two classes.[3]

Allen likely would have benefitted from being in a class with other students who were similar to him cognitively and linguistically and who had more mature behavior. Aside from his difficulty transitioning from a preferred to a non-preferred activity, many of his disruptive behavioral habits may also have stemmed from being bored or not challenged cognitively. Being in a classroom that could offer him academic support on his level would have helped him cognitively and may have prevented him from becoming bored. Additionally, Allen likely would have benefitted from the example of good behavior of more behaviorally mature students, as this was absent in his class.

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[2] I recommended to camp administration that Allen be moved to another class, suggesting that it would help him socially, behaviorally, and academically, but for reasons not disclosed to me, he remained in the lower class for the duration of the camp.

[3] Allen was the only student in his class to participate in the study.

Just as students with DS benefit academically and behaviorally by being in a class of TD students, Allen likely would have benefitted from being in a class of students at or above his cognitive level. Finally, he likely could have benefitted from being with other students who may have been able to interact with him socially. Though I recommended to the camp administration that he be moved to the next class, he remained in the lowest class for the duration of the camp. His teachers also expressed in the post-intervention interview that he likely would have benefitted in many ways from being placed in a different class. As one teacher said, “I wonder if it would be a different story if he was able to be in a foreign language classroom with typical peers.”

Apart from his challenges in class, Allen struggled to complete both the pre- and post-assessments. He needed frequent breaks not only between assessments but also during any given assessment. For example, he was unable to complete the PPVT-4 and the EVT-2 without multiple breaks. This is likely due to a short attention span combined with a large vocabulary which caused the duration of the tests to extend well beyond his capacity for sustained attention. In the post-assessments he did not reach a ceiling in the PPVT-4 until item number 108, and similarly did not reach a ceiling in the EVT-2 until item number 110. As a result of his need for frequent breaks and the longer duration of his assessments, Allen was unable to complete his pre-or post-assessments in one session.[4] Thus, rather than completing the NWRT in the same session as his other L1 vocabulary pre-intervention assessments, he completed it before class on the first day of camp. Additionally, when administered the KBIT-2 the second day of camp by the trained administrator he refused to participate, and I administered the KBIT-2 to him

[4] It should be noted here that during the post-assessment, students began the PPVT-4 and the EVT-2 based on the basal set during their pre-intervention assessment not on item number one. Ceiling requirements of eight incorrect items in a set for the PPVT-4 and five consecutive incorrect items for the EVT-2 meant that every time a student was approaching the ceiling requirement but then correctly answered an item, the test had to continue. For many students this was not a problem, but for a student with a large vocabulary like Allen, it caused the test to extend beyond his concentration ability.

toward the end of camp when he was better able to adjust to a change in his schedule. Allen was also unable to complete the full battery of post-assessments in one session. He completed the PPVT-4 and EVT-2 in an office room at a local institution of higher education and later that day I went to his house and administered the Spanish language assessments. He was sitting at the kitchen table strapped in his seat and eating a snack and seemed able to focus better in a more familiar environment.

Despite the many challenges Allen faced, he still demonstrated considerable Spanish acquisition. His mean number of items correctly answered on the four assessments (*M*=12) fell just below the mean of the rest of the intervention participants (*M*=12.83). The success that Allen experienced in acquiring Spanish is even more evident when considering the words to which he was not exposed in his class. Allen correctly produced fifteen of the items on the EVCBT (42.86 percent). However, if the items to which he was not exposed due to the absence of stories in his class are removed, then he correctly stated 55.56 percent of the items. Similarly, if the same is taken into account for the RVCBT, then the percentage of items correctly identified increases from 48.89 percent (twenty-two items) to 55.56 percent (twenty items). It is likely that if Allen had been in one of the other two classes with richer input and had he not missed so much class due to his absences and behavioral difficulties, he would have demonstrated even more acquisition.[5]

Case Study 2: Sammy

At the start of the Spanish intervention Sammy was nine years and six months old and had completed second grade. He had a developmental age of below four years old and was in the process of being screened for autism. Shortly after the completion of the Spanish intervention Sammy was diagnosed with ASD. As with most children with DS,

[5] Aside from not being present in class or not attending to the lesson due to behavioral difficulties, Allen was absent five days out of thirty.

his receptive language abilities exceeded his expressive. Sammy's pre-intervention receptive language age-equivalent score was two years and eleven months, while no age-equivalent was given for his expressive skills, indicating that it was below the lowest age range specified of two years and zero months. Of the intervention participants he was among those with the lowest linguistic and cognitive abilities, having obtained a raw score of four on the KBIT-2, reflective of the general trend of individuals with a dual diagnosis to have lower cognitive and linguistic abilities than their peers with DS only.[6]

Sammy attended one school year of Spanish class with me during his kindergarten year, two years prior to this Spanish intervention. Classes met once a week for forty-five minutes, reaching a total of approximately twenty-six hours of instruction. However, Sammy was often missing from class due to extreme disruptive behavior such as hitting classmates or knocking over furniture, and he struggled to attend to the lessons. From my observations during his initial year of Spanish with me, he had acquired at least one word, *camina* (walk) and could demonstrate it by walking when given the command in English, even outside of the context of Spanish class. Since his year of Spanish class two years prior, Sammy had no meaningful interaction with Spanish. When I met him for his pre-intervention assessments, I gave him the command *camina* (walk) and he had no reaction, indicating that what language he may have acquired from his initial exposure to Spanish likely had not been maintained.

Sammy had high sensory needs which were evident throughout the camp day

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[6] For cognition see Cynthia A. Molloy et al., "Differences in the Clinical Presentation of Trisomy 21 with and without Autism," *JIDR* 53, no. 2 (2009): 146–47; Ulrika Wester Oxelgren et al., "Prevalence of Autism and Attention-Deficit–Hyperactivity Disorder in Down Syndrome: A Population-Based Study," *Developmental Medicine & Child Neurology* 59, no. 3 (2017): 279–80. For linguistic abilities see Molloy et al., "Differences in the Clinical Presentation," 146–47; Georgina Warner et al., "Autism Characteristics and Behavioural Disturbances in∼ 500 Children with Down's Syndrome in England and Wales," *Autism* Research 7, no. 4 (2014): 435–38; Alexandria Cook, Emily D. Quinn, and Charity Rowland, "Exploring Expressive Communication Skills in a Cross-Sectional Sample of Individuals with a Dual Diagnosis of Autism Spectrum Disorder and Down Syndrome," *American Journal on Intellectual and Developmental Disabilities* 126, no. 2 (2021): 97–113.

and in Spanish class. These sensory needs were met through extra breaks in the form of walks with a weighted ball and weighted backpack, receiving pressure massages, or sitting with a weighted blanket. As a result of his sensory needs, Sammy required quite a bit of support to stay present and engaged in Spanish class, though the level of support needed lessened as the six weeks progressed. At the beginning of the six weeks, he was often absent from the room for a considerable portion of class or would spend most of the session trying to get out of the classroom, asking to go home, go outside, go for a walk, or go to the restroom. Sometimes when he left the room for a bathroom break or walk, upon his return to class he would sit by himself on the floor next to the door instead of engaging in the lesson with the rest of the class. However, as he became more comfortable with the language and the routine and activities of Spanish class, these escape behaviors decreased. Though they never ceased completely, by the end of the six weeks he was able to stay in the class for the entire forty-five minutes and his requests to leave were at a minimum. After the first three-week session when he would request to go for a walk, instead of taking him out of the room, a teacher would walk with him around the room. This helped increase his presence in the classroom as well as his engagement in the activities.

In general, Sammy struggled to sustain his attention in Spanish class. He would demonstrate disengagement by staring at the ground and displaying stimming (self-stimulatory) behaviors such as rocking back and forth, swinging his toy shark back and forth and watching it, and in some situations, pushing over chairs or other outburst behaviors. These behaviors were especially prominent during story time, as he often became disengaged and tuned out during at least a portion of story time, though they were likely to occur during any sedentary activity. However, stimming during story time was not always indicative of complete disengagement. It seems he was sometimes still listening to the story and aware of what was happening around him while stimming, because sometimes while stimming during story time he would make a verbal interjection related to the story. Though he initially struggled to pay attention during story time, by the end of the six weeks he was showing increased interest and engagement in the stories, often interrupting the story to act out what was being said. For example, when telling a story about a frog, and I would say *rana* (frog) he would call for my attention, squat and jump like a frog, and say "Bibbit! Bibbit!" Such actions demonstrated not only his engagement with Spanish, but his comprehension of the language. Additionally, his rocking back and forth was often a sign of excitement in response to the activity in which we were engaging, rather than disengagement.

Aside from sensory breaks such as pressure massages or walks, Sammy often needed redirects to sustain attention in class, and wait time after instructions were given in order to follow through with the instructions. Other support that Sammy needed was modeling of instructions, especially when engaging in a more complex activity such as acting out a story with a prop, or help engaging in and completing an activity such as pointing to the colors on the page while listening to the color song. Sammy's requests to leave Spanish class, difficulty concentrating, and need for assistance to complete some tasks or participate in some activities do not necessarily reflect a negative attitude toward Spanish. His teacher reported that his level of engagement and independence in Spanish class exceeded that of his level in other activities at camp, and that he participated in Spanish much more than in any other special area. Additionally, she noted that Sammy "thrives on one-on-one assistance, direct feedback, practicing, reminders" and "what he needed in Spanish is what he needed everywhere." The time of day in which his class had Spanish also likely contributed to his requests to leave class and engagement in self-stimulatory behaviors. Spanish took place in the latter part of the day (1 p.m.) when he was beginning to reach his limit and needed a break from activities and concentration. His teacher reported that he was often overwhelmed and overstimulated by this time of the day, which resulted in his need to leave the room for a walk or have some other kind of sensory break.

Despite his attempts to leave class and his disengagement in class, Sammy's overall disposition toward Spanish was quite positive. His mother reported that when hearing my name or the word "Spanish" he would he get excited and smile and exclaim, "Spanish!" Similarly, his teacher reported that "he would be very excited about Spanish, clap and be smiley and happy," and when reviewing the daily schedule would say, "Yay Spanish!" Sammy was eager to use Spanish inside and outside of Spanish class, especially his favorite song, *la tortuga camina lento* (the turtle walks slowly), which he would sing at home and in various contexts at camp (especially in the bathroom!). Almost anytime he saw me in the hallway he would stop me to sing the song and act out the motions and would also interrupt class several times throughout a forty-five-minute session to sing the song to me. When particularly engaged in class Sammy would repeat words that I was saying in Spanish, such as body parts, animals, and verbs, or interject his feelings about what was happening in class. For example, when excited about the story and video of a cat eating pizza he repeatedly said, "Cute! Yum!"

Sammy was very eager to express his feelings in Spanish. Often when I would enter the room with my cart, which had a poster on it with emoji emotion faces, he would stop me and point to the emoji of how he felt (happy, sad, or tired). I would say it to him in Spanish, and then he would usually repeat it and make a face demonstrating the feeling. He began to express feelings of happiness or sadness in Spanish spontaneously both during Spanish class and in other contexts as well. For example, during a break during his post-intervention assessments we were in the sensory room, and he was happily swinging on a swing. He looked up at me and with a big smile on his face exclaimed, "*¡Feliz!*" (Happy!). His teacher also reported that he would use the words *feliz* (happy) and *triste* (sad) throughout the day to express how he was feeling. For instance, when denied the opportunity to go outside and play he may respond with *triste* (sad) and make a sad face. Such use of the language demonstrates not only his positive attitude toward the language but understanding and acquisition.

In class, Sammy demonstrated both understanding and non-comprehension of the language. He demonstrated comprehension through responding correctly to simple instructions such as *levántate* (stand up), or *siéntate* (sit down), acting out words that were spoken or part of a song such as *baila* (dance), *duerme* (sleep), or *salta* (jump), correctly identifying animals that were projected on the screen, and saying the name of an animal and acting it out or making the sign for it. For instance, he said, *pez* (fish) and moved his hand like a fish. He showed increased understanding and language acquisition by saying an action such as *camina* (walk) or *duerme* (sleep) and then acting it out. Sammy could also respond to simple questions directed to him in Spanish, such as when asked if he wanted a turn participating in an activity or if he wanted to listen to a particular song. Though his responses were typically in English, they indicated his comprehension of the question. Sammy would also sometimes repeat in English what was being said in Spanish. For example, after singing a song I said, "*más rápido*" (faster), indicating to the class that we were going to sing it again more quickly, and he exclaimed, "faster!"

Conversely, Sammy demonstrated non-comprehension by incorrectly identifying animals that were projected on the screen, and inability to follow through with instructions or act out what was being said in Spanish. To support Sammy when he did not understand what was being asked of him, I would use gestures, signs, model what was expected, or have someone else, such as a teacher, model for him. For example, if it was his turn to touch an animal on the screen and he touched the wrong animal, I would make the sign for the animal I was asking him to touch while simultaneously saying the word until he was able to touch the correct animal. Sammy especially struggled to act out the stories with manipulatives as I narrated, likely due in part to non-comprehension. However, due to his regular disengagement, it was sometimes difficult to distinguish if Sammy was struggling with comprehension or attention and compliance. His low cognitive skills may also have contributed to the difficulties he experienced in carrying out more complex tasks such as acting out a story with manipulatives.

Sammy especially enjoyed activities which involved music or gave him a turn to show off his skills, and flourished when he received praise for his success. When experiencing success and receiving praise he would often become overcome with happiness and run to his teacher to hug her enthusiastically. Some of Sammy's favorite activities included having a turn to guess which box the monster puppet was sleeping in, saying hello to monster, using props to act out some of his favorite songs, and having a turn to identify the animals on the screen. Though he often struggled to correctly identify the animal solicited, his turn always ended in success, and he was thus always excited to have a turn. Two of the video songs we sang became favorites for Sammy, and he began to request them every class. He would generally request the song by acting out part of the song.

As Sammy became more confident in his Spanish skills he began to interrupt during class and make specific requests more often. I generally tried to acknowledge his interjections to demonstrate that I was listening to him and to keep him engaged in class. His interjections were sometimes related to what was happening in class. For example, during a story about a cat he would constantly interrupt and make a cat noise and do the gesture for cat. However, his interjections were not always on topic. For example, he would often get my attention and begin singing his favorite song, *la tortuga camina lento* (the turtle walks slowly) and act out the motions. Though his interjections were sometimes off topic, they were generally interjections in Spanish or related to some topic that we had recently been covering in class. However, it got to a point where Sammy's interjections were becoming overly disruptive and inhibiting the class from progressing in the lesson.

To balance maintaining his engagement and praising him for using Spanish on the one hand and continuing with the lesson on the other, I began to use strategies such as telling him, *un momento* (one moment) and holding up my finger to indicate that he needed to wait, or tell him that first we would complete what we were doing, and then we would watch him or engage in the activity he wanted to do. Other times I would incorporate his interjections into the lesson and use them as an opportunity to offer more input in Spanish. For instance, during the story about a cat, when he would interrupt and wanted everyone to watch him while he acted like a cat I would say, "*Sammy es un gato*" (Sammy is a cat). When the cat cried in the story and he stopped us to demonstrate crying, I said, "*Sammy llora*" (Sammy is crying). His teacher noted that learning how to initiate conversations or appropriately express his wants and needs is a general skill that he is working on, and he did improve in learning to wait to be heard toward the end of the six weeks.

Most of the acquisition Sammy demonstrated on the post-intervention assessments was receptive. This is not surprising given his limited expressive abilities in English. Of the expressive words solicited on the EWOPVT-B and EVCBT he only produced one word, *feliz* (happy). During the expressive assessments he would generally respond in English. When I would ask him to tell me the word in Spanish he would respond, "Spanish." By the time we arrived to the RVCBT, the last of six assessments, Sammy had been participating in the assessments (with regular breaks) for an hour, and it was extremely difficult for him to concentrate. Sammy likely would have benefitted from multiple assessment sessions, or alternative forms of assessment. His frequent use of Spanish in class, in other contexts at camp, and at home demonstrate that he likely acquired much more Spanish than what his assessments reflect.

It is also worth noting that Sammy's English vocabulary skills, as measured by the PPVT-4 and EVT-2, increased from pre- to post-intervention assessments. Sammy's receptive GSV (growth scale value) increased by seven points and his expressive GSV increased by eighteen points, a statistically significant improvement.[7] His receptive age level equivalent increased from two years, eleven months to three years, four months, and his expressive age level equivalent increased from below two years old to two years, four months. Though it cannot be claimed that exposure to a FL helped improve his L1 vocabulary skills, it does not appear to have harmed his L1 skills, as they were able to grow in only six weeks while being exposed to and acquiring a FL.

Sammy's teacher not only saw him at camp, but also babysat for him periodically at home. Her words sum up his experience well:

> He uses it (Spanish) throughout the day at (camp) and he says things at home. I feel like he might not say it all, but I do truly think he learned Spanish, and he understands it, everything you talked about in class. If we could find different ways to assess him—assessment depends on his mood. If he were to be assessed over a number of days, everything you taught him he would be able to demonstrate. He went from very passive and not saying anything to being very engaged and frequently using Spanish. He doesn't talk a lot in general, so the fact that he used so many Spanish words was very impressive to me.

Case Study 3: Grace

At the beginning of the Spanish intervention, Grace was nine years and seven months old, had completed second grade, and had a developmental age of less than four years of age. Upon beginning the Spanish intervention, she had an English receptive age-equivalent of two years and four months. Grace has a dual diagnosis of ASD and is non-verbal, and used mainly gestures and basic American Sign Language (ASL) to communicate, though she was learning how to use an electronic AAC (augmentative and alternative communication) device to communicate as well. Like Sammy, her cognitive and linguistic profile reflected the broader population of individuals with a dual

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[7] Growth scale value "is an indicator of the absolute level of performance" and is "designed (to measure) change over time." Kathleen T. Williams, *The Expressive Vocabulary Test Manual*, 2nd ed. (Minneapolis: NCS Pearson, 2007), 221. An increase in expressive GSV for a person Sammy's age reaches statistical significance after an increase of seven points. Sammy's expressive GSV increased by eighteen points, over double that required for statistical significance, indicating a highly significant increase in expressive English vocabulary.

diagnosis, many of whom do not develop spoken language.[8] However, being nonverbal did not prevent or hinder Grace from fully participating in Spanish class. She was able to participate through pointing when given options, using gestures and facial expressions, acting out songs and dancing, and responding to commands. She also periodically made use of her AAC by pointing to the animals in her AAC when they were mentioned in Spanish.

Grace's experience in Spanish class developed throughout the duration of the course. She began the course needing high support and scaffolding, displaying low engagement, and only occasional enjoyment of the class. However, she ended the six-week course with high engagement, little scaffolding needed for comprehension, and high enjoyment of the class, as reported both by classroom teachers and her mother. The beginning of the second three-week session seemed to mark a new stage for her, in which she comprehended enough Spanish to need less support and showed greater enthusiasm for the class both during class and when Spanish class was mentioned outside of Spanish class time.

Grace's most formidable barriers to participating in class and benefitting from the activities and instruction were her difficulty attending to the activity and following detailed instructions for an activity. Her difficulty to attend was especially salient during story time, particularly during the first few weeks of class. She would often seem disengaged and look in a different direction rather than directing her eyes toward me or the props when the story was being told. However, as her comprehension improved and she became more familiar with the routine, she began to enjoy story time more and attend better to the story. The last couple of weeks of the intervention she even began to be the first one to the story time circle when the class was told in Spanish that it was story time

[8] George T. Capone et al., "Down Syndrome and Comorbid Autism-Spectrum Disorder: Characterization Using the Aberrant Behavior Checklist," *American Journal of Medical Genetics Part A 134,* no. 4 (2005): 376; Warner et al., "Autism Characteristics and Behavioural Disturbances," 436.

and was instructed to come sit on the floor. She began to engage in story time and demonstrate comprehension by using gestures to reflect the words in the story. For example, when I said “*rana*” (frog) she made the gesture for frog, and when I said “*feliz*” (happy), she made a smiling face and pointed to her cheeks. On another occasion when we talked about the emotional state of the character, she got up and went to the emoji icon poster to point to the happy and sad emojis.

During story time and other activities that did not require her active physical engagement (such as dancing or acting out something), Grace displayed disengagement by looking around, turning away from the activity, or laying on the floor. Other signs of disengagement included watching other students, particularly those who were very engaged in class, or playing with objects at her desk. She also had some health issues which caused her to feel poorly and thus disengage from the class activities. Grace would occasionally express her frustration or lack of comprehension by shutting down and disengaging and leaning over or swiping her materials or other objects on her desk, a common behavior that she displayed when frustrated in other contexts as well. However, swiping objects was only demonstrated toward the beginning of the six weeks, when her comprehension was low. Conversely, Grace demonstrated engagement by listening, looking at the teacher or the board, and watching very intently. As the intervention progressed, she also demonstrated engagement by getting up quickly for activities, getting excited, and vocalizing. Her teachers reported that overall, Grace was more engaged in Spanish class than in other activities at the camp because “she didn’t really know she was working. For her it felt like a game, and it was fun.”

In order to participate fully in all of the activities in Spanish class Grace occasionally needed one-on-one support from a classroom teacher. This was especially true when the activity involved manipulating small props to act out a story or following detailed instructions. After I told a story with illustrations and props to support comprehension, each child would be given a set of small manipulatives (usually printed, laminated, and cut out pictures of the main characters, objects, and/or places in the story). I would retell the story and act it out with the larger props while each child acted out the story with their manipulatives. Many children needed some support to complete this activity, especially the first few times we did it, but Grace usually needed a teacher to give her hand-over-hand support or show her what to do. She also needed extra support to participate in the color song, in which each student had a sheet with different colored circles and had to touch each colored circle as they sang it in the song. Grace seemed to have a special aversion to this activity. Though she seemed to know her colors in English, she generally did not want to participate or would point to random colors during the activity. Thus, though Grace was not able to be completely independent in Spanish class, she was able to participate fully with the support of an assistant. Her teachers reported that the amount of support she needed in Spanish class was similar to what was needed in other subjects in the camp.

Grace particularly enjoyed activities which required physical movement or which allowed her to have a turn to participate in an activity. Her teacher reported that "She would get excited in class and wanted to be the first one to do everything . . . She wanted to do things that were asked of her in (Spanish) class because it made her successful. It was obvious she wanted to be involved compared to even other subjects. She was very interested in Spanish." One of the activities in which Grace experienced the highest rate of success was identifying animals on the white board. Pictures of several animals would be displayed on the white board, and I would tell her the name of an animal in Spanish for her to touch, often with the gesture for that animal for comprehension support. However, Grace was one of the first students in the class to be able to identify animals consistently without the support of gestures.

Grace highly enjoyed music videos which allowed her to dance or perform actions. At the beginning of the intervention she needed one-on-one support to follow along with the actions. For example, in a song in which the child should follow along by touching different body parts, Grace needed a teacher to give her hand over hand support to help her touch her body parts. However, as she became more familiar with the songs, she no longer needed such support. I also provided additional support and input to Grace (as well as other students) by describing what she was doing as she followed the motions to a song. For instance, if she was walking, I would say "*Grace camina*" (Grace walks), or if she was jumping, I would say, "*Grace salta*" (Grace jumps). Once Grace became familiar with the songs, songs and music videos allowed her to participate without the support of a teacher, though she would often look to her classmates and mimic them rather than watching the video.

She also enjoyed acting out songs or stories independently, though she sometimes needed scaffolding, such as the example of a teacher to act out the meaning of the song or story. For example, one of Grace's favorite songs said, "*El caballo corre, corre, corre. El caballo corre rápido.*" (The horse runs, runs, runs. The horse runs quickly.) When it is a child's turn to act out the song, they hold a horse face on a popsicle stick while the class sings the song, and the child runs like a horse. When given a turn to do this independently, Grace would sometimes hold the horse mask and stand still while the class sang. However, when I ran along with her while the class sang, she also ran. Grace's need for support in such activities varied and may have been due to factors other than comprehension, as she was able to perform this same activity independently on other occasions, demonstrating her comprehension by speeding up her running when the class sang "*rápido*" (quickly).

Grace also demonstrated understanding by responding to commands, especially when supported with gestures or signs. However, as the class progressed, she required the use of gestures for common commands less and less such that by the end of the intervention she was consistently responding without the support of signs or gestures. She also demonstrated understanding by indicating her choice by pointing when given two options. For example, when it was her turn to look for the hidden sleeping monster, I told her "*Grace, ven. Sí, ven*." (Grace, come. Yes, come.) and motioned for her to come to me. She came to me immediately. We looked at the cart where Monster was sleeping and I asked her, "*¿Grace, Monstruo duerme en el uno o el dos?*" (Grace, is Monster sleeping in one or two?), while pointing to each box, to which Grace responded by pointing to box number two.

Grace would sit or stand when told to in Spanish, especially when gestures were used for support, and would occasionally use the gestures to tell other students to sit or stand when they were not responding to my commands in Spanish. She also used gestures to spontaneously communicate her desires. For example, when it was her turn to come to the board to touch an animal and I told her to touch the cat, she put her hands together over her head, making the gesture for shark. This happened a few times until I told her, "*toca el tiburón*" (touch the shark), at which time she touched the shark, confirming she was soliciting that she wanted me to tell her to touch shark.

Grace's special job in Spanish class was to turn the lights on and off when needed, generally before or after watching a video. I began giving her these instructions with maximum support, using gestures and pointing to the lights and light switch while standing over the keyboard, indicating that we were going to watch a video. Eventually I could say the phrase "*Prende la luz*" (turn on the light) or "*Apaga la luz*" (turn off the light) without saying her name first to call her attention, standing away from the keyboard, and without the use of gestures to support comprehension, and she would immediately go to the light and turn it on or off. She was also able to understand when she was not allowed to turn the lights on or off. During one class when the students were coloring, I turned on a color music video, at which point Grace looked toward the light switch like she wanted to turn off the lights. I told her, "*No, Grace. No apagues la luz*." (No, Grace. Don't turn off the lights). Grace refrained from turning the lights off, though she seemed a bit upset or disappointed that she was not allowed to. Additionally, her classroom teachers began to use these phrases, along with other Spanish words and phrases with her outside of Spanish class, and she was able to respond appropriately.

Grace was able to demonstrate her understanding of Spanish not only in the classroom but in other contexts such as her home. She demonstrated her understanding of various animals and verbs to her family by acting out words with gestures and appropriate sounds that her mom said in Spanish, which her mother recorded on video. Grace demonstrated that her acting out of words was not mere repetition or memorization of gestures, but true comprehension, when she used the ASL sign for dog when her mother said, "*perro*" (dog), as opposed to the gesture we used for dog in Spanish class. Furthermore, Grace demonstrated her understanding at home by pointing to pictures in the story books I sent home when her mother solicited her to do so, indicating names of animals and descriptive words such as *rápido* (fast) and *lento* (slow).

Grace's post-intervention results may have been affected by her health. Though she appeared to be in good spirits during the assessment, prior to the assessment she spent a few days in the hospital and was released only a couple of days before the assessment. Nonetheless, she demonstrated considerable receptive Spanish acquisition, correctly identifying 10 out of 34 words in the ROWPVT and 23 out of 45 words in the RVCBT. Grace showed further comprehension during the RVCBT by doing the signs, gestures, and/or acting out many of the words. For example, when I said "*canta*" (sings), she held her hand up as if she were holding a microphone and made singing noises. When I said "*corre*" (runs), she moved her arms quickly as if running, and when I said "*triste*" (sad), she made a sad face.

Whether or not Grace's English vocabulary was affected by participation in the Spanish class is not clear. Though Grace scored a lower raw score on her post-intervention receptive English vocabulary assessment (PPVT-4), her receptive age equivalent of two years and four months remained the same. Additionally, the decrease in her receptive GSV from pre- to post -intervention just fell short of statistical significance. Despite significant challenges, Grace demonstrated considerable receptive Spanish acquisition and grew in her enjoyment of the language and the class. She was able to demonstrate her skills outside of the Spanish class and outside of the classroom. Her participation and acquisition far exceeded the expectation of her mother and her classroom teachers, demonstrating that even children with multiple disabilities are able to begin learning a foreign language.

Case Study 4: Rusty

At the start of the Spanish intervention Rusty was eleven years and six months old and had completed fourth grade. He had a developmental age of five years and eight months. Rusty's English language profile is typical of that of a child with DS in that his receptive language exceeds that of expressive. At the start of the Spanish intervention Rusty had a receptive age-equivalent of six years, four months, and an expressive age-equivalent of five years, four months. Among intervention participants, Rusty had the highest L1 receptive scores, both pre- and post-intervention.

Rusty showed high engagement and experienced success in Spanish class from the very beginning. Initial engagement was demonstrated by mimicking gestures, attempting to sing along with songs, acting out the motions to songs and stories, and interaction during stories. For example, on the second day of class when I said, "*rápido*" (quickly) he moved his hands quickly as I had modeled previously. When telling a story about a horse I said, "*el caballo se despierta*" (the horse wakes up) and stretched my arms out like I was waking up. Rusty mimicked the motions and pretended to be waking up. Later in the story when the horse was eating, he suggested that the horse eat a hamburger, demonstrating not only true engagement with the story but understanding of what was happening in the story. When watching a video with the actions *camina* (walk), *baila* (dance), *salta* (jump), and *duerme* (sleep), Rusty engaged in all the actions.

Rusty also demonstrated understanding early on by responding to questions asked of the class. He used English and signs or gestures to communicate when he did not have the verbal skills to respond in Spanish. For instance, on the second day of class when we were looking for the puppet monster and I asked, "*¿Monstruo duerme en el uno?*" (Is Monster sleeping in number one?), Rusty nodded his head and said, "yeah." He would also use the signs which I had modeled for *sí* (yes) and *no* (no) to demonstrate his agreement or disagreement with a number someone else in the class had guessed and hold up his fingers to indicate which number box he thought Monster was sleeping in. When I displayed a picture of a horse on the screen and asked the class, "*¿Es un elefante?*" (Is it an elephant?) and made an elephant noise, he made the sign for *caballo* (horse). Rusty demonstrated understanding not only by responding to questions but by responding correctly to instructions and was often one of the first students in the class to do so. For example, when I would say, "*la clase se levanta*" (the class stands up), Rusty was generally one of the first students to stand up.

Despite his general high level of engagement, the first three weeks of class Rusty sometimes showed a hesitancy to participate in activities. This was usually if the activity involved standing or lots of movement. He also sometimes struggled to maintain attention and occasionally needed a reminder to look forward or listen. However, this seemed due not to a lack of desire to participate in Spanish but rather from being tired. Spanish class was the last activity of the day (2 p.m.) and most of the students in his class were tired by that time. The second term of the camp class was moved to 10:45 a.m. and this increased participation and energy on the part of all the students, including Rusty.

During the second term Rusty maintained a high level of engagement, though not without occasional challenges. When having difficulty focusing Rusty may become fidgety and benefit from sensory support such as a fidget toy or sensory tile (to stand or step on).[9] Another significant factor which at times affected Rusty's engagement and

[9] Rusty's need for sensory support was quite minimal, especially when compared to many other students in the class. Generally, a reminder from a teacher to pay attention or participate would suffice to get him back on track or keep him focused.

focus during class was disruptive behaviors by classmates. At times he was able to ignore these distractions with the help of a teacher but at other times the disruption was too great to ignore.[10] Additionally, if he was struggling with attention during the rest of the day, he was likely to struggle with it in Spanish as well. Changes in the camp schedule, lack of sleep, and disagreements with friends also adversely affected his attention and participation in class.

As Rusty's acquisition of the language increased, he began to mimic not only signs, but words, and soon was using words along with signs and gestures to communicate in class. By the second week of class Rusty began to repeat some words in Spanish, with the number of words he spoke each class steadily increasing. By the fourth week of class Rusty was beginning not only to repeat words but to produce some words correctly in context. For example, when I asked the class, "*¿Qué color es el caballo?*" (What color is the horse?), Rusty responded confidently, "*café*" (brown), indicating his ability to understand the question and respond in Spanish. Likewise, when listening to a song which asks what color the animals are, Rusty was able to correctly answer most of the questions in Spanish before the color was said in the song. He correctly responded with: *rojo*, *rosa, gris, morado*, *negro, blanco,* and *café* (red, pink, grey, purple, black, white, and brown).

However, even when incorporating more speaking in Spanish in class, Rusty often relied on gestures to communicate. When singing the song "Head and Shoulders" we would successively get faster, and after each round I would say, "*más rápido*" (faster). Rusty wanted to go more slowly and repeatedly made the action for *lento* (slow) until I saw him and acknowledged his request. He repeated the sign and said, "like this."

[10] When the disruption was too loud or distracting for me to talk over or for the students to concentrate, I would generally wait until it was finished to the continue with the lesson. On at least one occasion when the disruption was exceptionally loud and lengthy and hindering the class from engaging in the lesson, I took the class outside and continued with class on the playground.

When I responded, "¿*lento*?" (slowly) he nodded and said, "yes." Throughout the duration of the course Rusty preferred to use the signs for yes and no rather than say *sí* (yes) and *no* (no) in Spanish. Similarly, he generally preferred to use his fingers to indicate his choice of number rather than say the number in Spanish when looking for the monster puppet.

Additionally, Rusty quickly gained the ability to respond to simple instructions without scaffolding such as the support of signs. By the fifth class when told *siéntate* (sit down) he sat down without me using the sign in tandem with the verbal command. His ability to respond to instructions without scaffolding increased throughout the course so that by the middle of week four he was able to successfully respond in the following situation: Students had laminated cards of various colors which had been used in a previous activity. I was instructing the students to stack them up in a certain order and would say something like, "*encima del negro pongan anaranjado*" (on top of black put orange). Rusty was able to choose the correct color without seeing me demonstrate about half of the time. Rusty's comprehension improved so that in certain circumstances he was able to anticipate when it was time to stand up to participate in an activity. For example, I might say "*Monstruo quiere bailar*" (Monster wants to dance), and before I had the opportunity to tell the class to stand up, Rusty was standing up in preparation to dance.

By the last week of class Rusty could read simple sentences in Spanish such as, *Hay cuatro monos cafés. Los monos comen.* (There are four brown monkeys. The monkeys eat). Though it was evident he mostly understood what the sentences meant by his ability to answer questions about them, he was generally unable to translate them from Spanish to English when reading it himself.[11] However, if a teacher read the

[11] Students were never taught how to read in Spanish but were exposed to text through the books that were sent home and the occasional word that I would write on the board when telling the story. Additionally, some of the videos that we watched included text or closed captions in Spanish. The last week of class as part of a cumulative project students colored sheets which would be compiled into a book

sentence to him, he was more likely to be able to say its meaning in English. Rusty was also able to predict some things that I was going to say. For example, to announce it's story time I always said, "*Es tiempo para el cuento*" (It's time for the story/It's story time). During the last week of class I began, "*Es tiempo. . .*" (it's time) and he said, "story time."

While Rusty participated well and enthusiastically in all activities, his favorite activities included music and dancing, acting out stories, looking for and interacting with the monster puppet, and pointing to the colors on a sheet while listening to the color song. He also expressed a like for story time, because on the few occasions when there was not a story, he asked when we were going to have the story. Rusty was generally the first person in class to volunteer for any activity, whether acting out a story or coming to the screen to point to an animal. His high understanding of the language allowed him to set an example for other students in how to participate in class, especially when the activity was more complicated, such as acting out a story. During the last week, when acting as a dog in a story and instructed to sit in his seat until he heard mention of his character, he stood up from his seat and began to run behind the cat when I said, "*el perro corre detrás del gato*" (the dog runs behind the cat). When the cat escaped from the dog and I said, "*el perro está triste*," (the dog is sad) he laid down on the floor and acted sad. Rusty generally needed less prompting than other students to correctly act out the details of a story as they were being narrated.

Though Rusty generally understood well, he did not always clearly comprehend the language being used. This was especially true if an activity was new and unfamiliar, if instructions were complicated, an open-ended question was asked to the entire class, or if he needed to understand more complex sentences. For example, when

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and sent home on the last day of class. Rusty would read these sentences to his teacher, and she would ask him questions about what the sentences meant.

following instructions in Spanish to illustrate the different body parts on the characters in a book, he sometimes got confused about which body part he was supposed to be drawing and may have been drawing a nose when the instructions were to draw eyes. During such instances he needed extra scaffolding such as gestures or signs or someone modeling the correct action, or occasional support in English. Rusty's lack of comprehension was sometimes evident by a confused look on his face. More directly, sometimes Rusty demonstrated lack of comprehension by asking in English, "what's that mean?" However, this happened only a few times, likely indicating that though he was able and willing to ask for comprehension help, he was generally able to understand sufficiently to not feel the need to ask for clarification. Rusty would sometimes answer a question under his breath, either in English or Spanish. Though he was not always brave enough to say the answer out loud he likely understood even more than he openly demonstrated. Encouragement from a teacher sometimes gave him the support he needed to say the answer out loud.

Rusty's overall attitude toward Spanish was positive. He struggled a bit at the beginning of the six weeks since it was challenging to be exposed to something that was new and confusing at the end of the day when he was tired. However, once his comprehension increased and classes were moved to the morning session, he began to be excited about the prospect of Spanish class. Once he was able to say some words in Spanish, Rusty began using his language outside of Spanish class at camp and at home. His mother reported that he "would frequently use Spanish words. While playing 'Eye Spy' he would use the Spanish words for the colors. He started calling our dog *perro*. When bowling I said we were going kind of slow. He responded, 'You mean *lento*?'"

Rusty even used his Spanish in the post-intervention assessments when completing his English vocabulary assessments. During the English expressive assessment Rusty responded several times with the correct word in Spanish such as *rosa* (pink), *lento* (slowly), and *perro* (dog). Though he only correctly stated one item in

Spanish on the EWOPVT-B, he would often say the color of the object in Spanish if he did not know the word. Additionally, Rusty correctly identified 13 out of 34 items on the ROWPVT-B and 34 out of 45 on the RVCBT, and correctly stated 15 out of 35 items on the EVCBT. Finally, Rusty experienced no significant change in his English vocabulary from pre- to post-intervention. His receptive GSV dropped by one point. Though this is a decrease, it does not approach significance and while it could represent an actual decrease in vocabulary, it is more likely a reflection of inconsistent performance on a standardized assessment, or reflective of the difference between forms A and B of the PPVT-4. Rusty's expressive GSV increased by four points. Though this does demonstrate some growth, it is not a statistically significant amount, and it may be concluded that exposure to a FL likely had no significant impact on his L1 vocabulary development.

Case Study 5: Rosie

At the start of the Spanish intervention Rosie was twelve years old, had completed fifth grade, and had a developmental age of four years and eight months. Unlike the typical language profile of children with DS, Rosie's expressive language skills exceed her receptive language skills as measured by the standardized assessments. At the start of the Spanish intervention, she had a receptive age-equivalent of five years and five months and an expressive age-equivalent of five years and six months. Her post-intervention assessments also revealed higher expressive than receptive L1 skills.

Rosie's ability to use expressive language likely contributed to her desire to speak in Spanish and ultimate success in acquiring a large amount of expressive vocabulary. From the first day of class Rosie consistently used gestures to communicate in Spanish class, though once she was able to say a word in Spanish, she generally chose to say the word along with the gesture. For example, when asked, "*¿Dónde duerme monstruo?*" (Where is monster sleeping?) she said, "*cinco*" (five) and held up five fingers. Similarly, once she was able to produce the word for yes, she would respond affirmatively to a question by saying *sí* (yes) and simultaneously use the sign for yes. Even after she was able to say the colors in Spanish, she would generally use the sign for them in tandem with the speaking the word in Spanish.

By the second day Rosie was repeating words in Spanish to demonstrate her understanding. For example, I pointed to a picture of a large horse and said, "*No es un caballo pequeño*" (It's not a small horse) and made a motion indicating small by bringing my hands close together, and continued, "*Es un caballo grande*" (It's a big horse) and spread my hands out far apart to indicate big, at which time Rosie interjected, "*grande*" (big). Rosie consistently looked for any opportunity to use the language she knew, be it by answering questions, making interjections, interacting during the story, or commenting on topics unrelated to the class. For example, if she had a horse on her shirt, she may point to it and say, "*caballo*" (horse). By the fourth week Rosie could correctly answer a question in Spanish when given two choices. For example, I made the monster puppet sing, "la, la, la, la, la," then asked Rosie, "¿M*onstruo canta o baila?*" (Does Monster sing or dance?), to which she responded, "*canta*" (sing). Similarly at the end of the story when asked, "*¿La rana está triste o feliz?*" (Is the frog happy or sad?), Rosie responded, "*feliz*" (happy).

Rosie eventually was able to express a wide variety of things in Spanish without prompting or being given a choice. The last week of class when the students were taking turns hugging the crying baby doll, I said, "*El bebé llora. Waawaa. El bebé está triste*" (The baby is crying. Waawaa. The baby is sad), to which Rosie responded, "*feliz*" (happy), indicating that the baby should be happy now that everyone has given it a hug. Even when Rosie didn´t have the precise vocabulary to express what she wanted to say she was able to circumlocute and use the vocabulary she did know to communicate. For instance, when Monster was eating both of his hands she yelled, "*¡uno, dos!*" (one, two!) and when he was eating his hands and his feet she yelled, "*¡cuatro!*" (four!) to indicate that he was eating both of his hands and then his hands and feet. By the last couple of weeks of class Rosie was consistently making relevant interjections. For example, as I was reading the title of a book, "*El gato y el perro*" (The cat and the dog) she exclaimed, "*¡negro!*" (black!) because the dog was black.

Toward the end of the six weeks Rosie often completed my sentences for me. When I began to read the book about a cat and a dog I showed the class the first picture of a cat and said, "*Había una vez un* . . ." (Once upon a time there was . . .) and she said, "*gato*" (cat). On another occasion when telling a story I said, "*el mono baila y está* . . ." (the monkey dances and is . . .) and without a pause Rosie finished the sentence with "*feliz*" (happy). Additionally, by the last week of class she was beginning to produce some basic sentences in Spanish. When I took the horse out of its box and made a neighing sound, Rosie exclaimed, "*¡El caballo es café!*" (The horse is brown!) and made the sign for *caballo* and *café* as she said the words. Similarly, when I took Monster out of his box and he sang, "*¡Hooolaaaaa clase!*" (hellooooooo class!), Rosie held her hand up to her mouth as if holding a microphone and said, "*Monstruo canta*" (Monster sings). Though she generally used the language correctly, she occasionally made a mistake, even with words she had previously demonstrated that she knew. After demonstrating on multiple occasions that she knew her colors, she once pointed to her blue shirt and said, "I have *rojo*" (I have red). However, Rosie did not make such mistakes often.

Rosie demonstrated comprehension and acquisition of the language not only through speech but through her facial expressions, body language, and actions. She demonstrated comprehension by reacting appropriately toward what was happening in class, for example laughing when something funny happened, looks of excitement when something exciting happened or she was anticipating that it would happen, or responding appropriately to verbal instructions. When watching a video of a race between a horse and a turtle she used the gestures for *rápido* (quickly) and *lento* (slowly) when the words were narrated on the video. When she heard, *la clase baila* (the class dances) she began to dance, and when I said, "*para*" (stop), she stopped. Before she was able to produce the names of the animals she could successfully point to the animal on the screen when instructed. By the beginning of the third week Rosie was able to point to the colors on the page during the color song without looking at the screen and before the color was sung in English. She also demonstrated a clear understanding of the language when she was able to act out details of a story. This is best demonstrated by a story she acted out during the last week of class. As I narrated and provided support with gestures Rosie successfully acted out sentences such as *el gato duerme* (the cat sleeps), *el gato corre* (the cat runs), *el gato sube un árbol* (the cat climbs a tree), and *el gato está feliz* (the cat is happy).

Rosie truly seemed to enjoy most any activity in Spanish class, but especially enjoyed the songs and any activity which involved movement. One of her favorite activities was to hold the horse face on a stick and run quickly in place as the class sang "*El caballo corre rápido*" (The horse runs quickly). Rosie initially participated in the songs by mimicking the gestures or doing the actions, and after only a few exposures to any song began to attempt to sing along. By the end of the term, she was able to sing the majority of the words to most of the songs in class. Even after learning the words, she continued to do all the motions and gestures to the songs while singing. For example, during one of the songs with animals she would sing the name of the animal while also doing the sign for the animal.

Rosie was very independent in Spanish class and was able to complete nearly every activity without support from a teacher and often served as a model to the other students for how to participate or complete an activity. She was generally one of the first students to respond to instructions and to volunteer to participate in an activity. She was very encouraging of her classmates when it was their turn to participate and would sometimes even prompt them in English or Spanish to tell them what to do. For example, when it was a classmate's turn to act out the story and I narrated, "*Susie corre*" (Susie runs) and Susie did not run, Rosie said emphatically, "*¡Susie, corre!*"

Aside from the occasional reminder to pay attention, Rosie independently maintained engagement in Spanish class. She periodically became distracted by her friend sitting at the table with her or with a toy she brought from home. If she was tired, she may lay her head down, but this generally only occurred between activities. Additionally, changes in the camp schedule sometimes affected her attention, though at other times she was able to maintain high engagement despite significant changes to the schedule. The most significant barrier to her engagement was disruptive behavior from classmates which at times could become very distracting for the entire class. Her teacher noted that Rosie needed fewer reminders to pay attention and less support to participate fully in Spanish class than in most other subjects and activities at camp, especially other academic subjects.

Rosie loved to use her Spanish outside of Spanish class. By the middle of the second week her teachers reported that she was repeating some of the words she had learned during snack time. As camp progressed and her vocabulary increased, she used Spanish more frequently in a variety of contexts, and her teachers consistently told me stories of how she was using her Spanish outside of Spanish class. For example, one day an ocean scene with relaxing music was projected on the screen in her class. When Rosie saw a shark on the screen, she made the shark sign and said, "*tiburón*" (shark). Likewise, when she saw a fish she said, "*pez*" (fish) and made the fish sign with her hands. During the last week of camp, I saw Rosie on the playground. As soon as she saw me, she began to run and exclaimed, "I *corre*!" (I runs!).

Rosie also used her Spanish at home. After only one week of Spanish class her parents, who knew no Spanish, reported resorting to looking through the story books that had been sent home to decipher what she was saying. They eventually contacted me and requested that I share with them the music videos we used in class because she was constantly singing songs in Spanish at home. Toward the end of the six weeks Rosie was speaking Spanish in class, in various contexts at camp, at home, and even outside of the home. Her mom reported that they went out to eat with another family and the subject of

Spanish class came up. Rosie proceeded to speak in Spanish, naming the colors of the clothing that people were wearing. Concerning her attitude toward and use of Spanish, Rosie's teacher said, "She's out in the community speaking Spanish. Proving people wrong. People don't expect kids with Down syndrome to speak another language. She is out there showing her understanding of a second language."

Rosie was able to demonstrate a considerable amount of Spanish acquisition in her post-intervention assessments, though the scores do not demonstrate the full extent of her acquisition. She correctly answered five out of thirty-four items on the EWOPVT-B. However, she demonstrated the ability to express beyond what was measured by the assessment and sometimes used Spanish to answer the question by responding with a related word when she did not know the precise word for the item. For example, when presented with a food item she responded with *come* (eats), and when the item was an ear, she responded with *escucha* (listens). Additionally, she often said the color of the item if she did not know the word in Spanish. Rosie correctly identified 13 out of 34 items in the ROWPVT-B and 41 out of 45 items on the RVCBT. Finally, she correctly stated 27 out of 35 items on the EVCBT.

While Rosie's L1 receptive GSV remained constant from pre- to post-intervention, her L1 expressive GSV increased by nine points, a statistically significant amount. Even while being exposed to a FL and gaining a considerable amount of expressive vocabulary in that language, she was able to demonstrate a significant increase in her L1 expressive vocabulary, indicating that exposure to a FL likely had no detrimental effect on her L1 vocabulary development. Reflecting on Rosie's experience in Spanish class and acquisition of the language her teacher stated, "I am very impressed with her and how much she learned. Not only the Spanish she used in Spanish class but how she used it in other contexts too. I feel like she could and should continue to learn Spanish. I think it would be beneficial for her to continue learning. She learned so much in 6 weeks." Rosie's mom expressed that she desired for Rosie to continue learning

Spanish and requested that her school incorporate goals for learning Spanish into her Individualized Education Program.

Research Question 1

Research question 1 asks, “How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?” I will answer the sub-questions to research question 1 based upon the information presented in the case studies and the various sources of data gathered for the case studies, as well as general observations from the intervention.

The first sub-question asks, “How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?” Students may demonstrate non-comprehension in the FL classroom in a variety of ways varying from very subtle hints to direct statements of non-comprehension. First, children may demonstrate non-comprehension with facial expressions or body language. When students do not understand the language being spoken, they may have a look of confusion on their faces. Similarly, they may express hesitancy in responding to instructions. For example, before students clearly understood the command *levántate* (stand up) they would often halfway stand up and then sit back down or stand up very slowly as if trying to decipher if they were doing the right thing. Similarly, if a student is confused, they may look at the teacher intently, waiting for clarification. For example, when instructing students to touch a certain animal on the screen, I generally also made the sign for the animal. I would occasionally not give a gesture to see if the child could answer without support. In the case that they could not identify the correct animal without the support of the gesture, they would often continue looking at me intently until I repeated the word with the scaffolding of a gesture. In more extreme instances non-comprehension may cause some students to feel extra stress and thus trigger behavioral outbursts or destructive behavior such as knocking over furniture or swiping objects off their desk.

However, it is sometimes difficult to discern if such behavior is truly from a lack of understanding or general stress and fatigue and a need for a break. It was likely often a combination of the two.

Further, non-comprehension may be demonstrated by a lack of response to a question or instructions. If a student does not understand the question that is being asked, rather than respond incorrectly, they may simply not respond to the question. Likewise, if a student is given instructions and does not follow through with those instructions, this may indicate a lack of understanding of the instructions. This is most likely when the instructions are complex and move beyond simple commands. In the same manner, refusal to participate in an activity could reflect that the child does not understand what is being asked of them or the language being used to narrate the activity. For example, if I was narrating a story and it was a student's turn to act out the story, yet they did not move, it often indicated that they did not understand what they were supposed to be acting out or did not understand the language indicating that it was their character's turn to act. In such cases they needed the support of gestures or modeling to comprehend what was being narrated. However, a lack of response to instructions and refusal to participate in an activity does not always indicate lack of comprehension but may indicate simple unwillingness to participate.

Similarly, students may respond to a question or prompt incorrectly. An incorrect response to a question may imply that the child does not understand the question. However, if the child is answering the question in the L1 it may simply reveal that they do not have the proper expressive vocabulary to answer the question correctly in the L2. Likewise, when a student responds to a prompt incorrectly it likely demonstrates lack of understanding. For example, if a child is prompted to touch the shark on the screen and instead touches the monkey, it is likely that they did not understand the word for shark. However, sometimes the child simply wanted to touch a different animal and would continue touching it until I said the name for that animal in Spanish. Once I acknowledged in Spanish the animal they wanted to touch, they would often touch the animal they were being instructed to touch.

Finally, students may demonstrate that they do not understand by making direct statements of non-comprehension. For example, a student may say, “what does that mean?” or “I don’t understand.” Though the most direct, this was the least common of the indicators of non-comprehension and was generally used by the older students. Overall, when given ample support and scaffolding in the form of simple language, gestures and signs, pictures, or modeling, students with DS are able to understand much of the L2 in a novice FL class.

The second sub-questions asks, “How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?” Students demonstrate understanding of the L2 in the FL classroom through a wide variety of responses, both verbal and nonverbal. Nonverbal indications of comprehension will be addressed first since these are most common and generally appear before verbal. First, students may express understanding through appropriate facial expressions and other body language. For example, when listening to a story and something funny happens, the student may laugh, or if the character is sad, the student may reflect a sad face as well. If something exciting happens, students may have a look of excitement on their faces or show excitement with some type of body language, such as putting their fists in the air in an expression of excitement or emitting an excited vocalization.

Furthermore, students may use signs, gestures, and pointing to indicate their comprehension of the language. Students may use signs or gestures to respond to questions, such as the signs for yes and no. They may also use signs for vocabulary, such as animals, colors, fast and slow, or any other sign or gesture that has been used in class. Students may use these signs to answer questions, show comprehension as they are listening to a story, or to express their desires. For instance, when listening to a story and the student hears the word *tortuga* (turtle) and proceeds to make the sign for *tortuga* they are indicating their comprehension. Similarly, if a student wants to sing a song quickly, they make the sign for *rápido* (quickly) to express their desire to sing the song faster. Finally, when given an option of two or more objects or pictures a student may indicate understanding by pointing to the answer or their preferred choice.

Other nonverbal indicators of comprehension in the FL classroom by children with DS include following instructions, responding correctly to prompts, responding with the proper actions, and acting out what is being narrated. Students show comprehension by following instructions given in the target language. For instance, if the teacher says *levántate* (stand up) and the student stands up, this is a clear indicator of comprehension. In a like manner, students demonstrate comprehension by responding correctly to prompts. If the student is prompted to touch the horse on the screen and they do so, they have understood not only the instructions but the word for horse. Additionally, students may indicate understanding by performing the proper actions. For instance, if a song says *salta* (jump), and the student jumps, they demonstrate understanding of the action being sung in the song. If we are singing a song about a fish swimming and the student acts out swimming, they demonstrate understanding of the word for swimming. Finally, students nonverbally demonstrate comprehension of the language by acting out what is being narrated. This is especially true if the student is able to act out what is being narrated without the support of gestures. Students may demonstrate understanding in this way by acting out with their own bodies what is being narrated, for example by running when their character is supposed to run, or acting out what is being narrated with manipulatives, such as making the horse run when I say "*el caballo corre*" (the horse runs).

In addition to nonverbal indicators, students with DS may indicate their comprehension of the L2 verbally. Verbal indicators of comprehension include interacting in the L1, answering questions verbally in the L1 or L2, and singing along to songs. First students may demonstrate understanding by interacting in the L1. For example, students may make relevant interjections in the L1 during a story or other activity. This could be in the form of translating what is being said or adding their ideas to the story. For instance, when I said, "*el caballo come*" (the horse eats), and a student interjected "hamburger," they indicated their understanding of what was happening in the story. More commonly, students will state in English what is being said in Spanish. For example, if I say, "*corre"* (runs), the student may say, "running!" or if I say, "*el mono está triste*," (the monkey is sad) the student may say, "he's sad." Additionally, students demonstrate understanding by answering questions in the L1 or the L2. If I ask, "*¿Qué color es el caballo?*" (What color is the horse?), the student may indicate understanding by responding in Spanish, "*café*" or in English, "brown."

Finally, students may demonstrate comprehension by singing along to songs. This is especially an indicator of comprehension when the student acts out the actions or does the appropriate gestures along with singing the words. For example, if the student sings *duerme* (sleeps) and then pretends to sleep, they are indicating their comprehension of what they are singing. Additionally, students demonstrate comprehension when they sing or say the lyrics before they arrive in the song. If the song asks, "*Delfín, ¿de qué color eres?*" (Dolphin, what color are you?) and the student responds in English, "blue" or in Spanish, "*azul*" before the song, they demonstrate their comprehension of what the question asks.

The third sub-questions asks, "What barriers exist to their participation in the foreign language classroom?" Barriers to the participation of children with DS in the FL classroom may be divided into internal and external barriers, though the delineation between the two is not always clearcut. First, internal factors may act as barriers to a student's full engagement or participation in a FL class. Internal barriers include short attention span, difficulty attending to relevant visual stimuli, sensory needs, mood and energy level, and behavior. A short attention span, common among children with DS, may make it challenging for a student to stay engaged in class. This is especially salient when an activity requires sustained attention, such as during story time. Children may also struggle to sustain attention during an activity in which every student gets a turn. However, children generally seemed engaged watching their classmates perform.

A unique behavior displayed by some students which impeded their full engagement in the class, particularly those students with ASD, was difficulty attending to the relevant stimuli by orienting their body and/or directing their eye gaze toward the focal point of activity. While most children with DS have difficulties with sustained attention, children with ASD also have impairments in social attention ("allocating attentional resources to social . . . stimuli") and joint attention ("sharing the focus of attention with other people to a common point of reference").[12] Thus, children with ASD not only have difficulty maintaining their attention over periods of time, but paying attention to people and to shared targets or objects, both of which are important for engagement in the FL classroom.[13] Both Sammy and Grace displayed this difficulty. They would often look away from the center of activity, such as myself when I was telling the story, or the screen when a video was being projected on it, rather than focusing their body and/or gaze toward it. This behavior was difficult to overcome, though positioning the child in close proximity to the center of attention (such as myself when telling a story) or turning their chair or body to fully face the screen when watching a video sometimes helped.

Furthermore, students with high sensory needs may face greater barriers to staying engaged in the FL classroom. They may need more frequent breaks or may become disengaged stimming or looking for some other kind of stimulation. For example, Sammy needed frequent breaks to walk around, or would often engage in rocking back

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[12] Giacomo Vivanti et al., "Social Attention, Joint Attention and Sustained Attention in Autism Spectrum Disorder and Williams Syndrome: Convergences and Divergences," *JADD* 47 (2017): 1867.

[13] Vivanti et al., "Social Attention," 1867.

and forth or spinning his shark toy as he watched it intently. Additionally, a student's mood and energy level may affect their engagement and participation. If a student is extra tired or in a negative mood, they may be less likely to engage fully in the activities in class. Grace encountered special difficulty due to health issues, which would negatively affect her mood and her ability to engage in class, often rubbing her stomach or lying on the floor rather than participating in class activities.

Finally, the internal factor which acts as the greatest barrier to a child's participation in the FL classroom is that child's own behavior. While this factor was not necessarily the most widespread among the children with DS who participated in this intervention, it was the most severe barrier for those who struggled to regulate their behavior in a positive way. Those students that struggled with regulating emotions, switching from preferred to non-preferred activities, or relinquishing control struggled more than their peers with DS to participate in the FL class. Behaviors such as outbursts, emotional meltdowns, and destructive behaviors such as throwing objects or knocking down furniture may prevent a child from participating fully in the class. Similarly, a child's own unwillingness to participate may prevent them from participating in class. This unwillingness may be caused by any number of internal factors, and it is often difficult to uncover the underlying reason. While an unwillingness to participate could be triggered from an external factor such as lack of comprehension, that did not seem to usually be the case.

External barriers include changes in schedules, distraction from a preferred object, difficulty understanding instructions or complex language and activities, and distracting or disruptive behavior from other students. Children with DS thrive on consistency and schedules, so when a child experiences a change in their schedule, this may affect their mood and thus their ability to participate in the FL class without distraction. This is an instance where an external factor may spur an interior barrier as the child may become internally distracted by the external change of schedule. Students may also be prevented from participating fully in the FL classroom if they have in their possession a preferred object such as an iPhone or iPad. The only case in which this was a barrier for any child in this intervention was for Allen, who had difficulty regulating his emotions and transitioning from a preferred activity to a non-preferred activity. He was sometimes given an iPhone or iPad to help him regulate his emotions and calm down. However, when the device would stay in his possession during Spanish class, it served as a barrier to his engagement and participation. This is an example of an internal factor (difficulty regulating emotions and transitions) which resulted in an external barrier (the distraction caused by a device).

Additionally, students with DS may experience barriers if the L2 being spoken in the class is beyond their comprehension. This may cause them to have trouble following instructions and thus participating in an activity, or they may not be able to understand the content being presented, for example, follow the plot of the story. Activities which involve a higher coordination between understanding and acting out details, such as acting out a story with manipulatives, may be challenging for some students with DS to complete independently. Finally, distracting or disruptive behavior from other students may prevent students with DS from participating fully in the FL class. For those students who were able to participate fully and independently, this was the one external factor which would sometimes prevent them from attending to the lesson and thus affect their participation. It is important to note that many of these barriers can easily be avoided or lessened by providing the proper scaffolding and support to students and thus in some sense should not be considered barriers but challenges.

The fourth sub-questions asks, “What type of support do children with Down syndrome need to successfully participate in the foreign language classroom?” The amount of support needed to successfully participate in the FL classroom varies widely among students with DS and may be divided into two broad categories: behavioral support and content support. Behavioral support is generally unrelated to the content or

L2 and pertains to the child's behavior and emotions while content support is any support needed to properly understand or respond to the L2 input in order to complete the activities in class. Behavioral support may be needed by children with DS in any classroom context, whereas content support is a bit more specific to the FL context.

Behavioral support needed to participate in the FL classroom may vary from basic support such as verbal reminders, to more in-depth support such as proximity control, sensory support, and support properly expressing needs or desires. Verbal reminders are reminders to pay attention, disengage from a distracting activity such as talking with a friend, or to follow instructions. A verbal reminder in this context, especially a reminder to follow instructions, is not related to the child's inability to understand the instructions in the L2, but rather an unwillingness to comply with what is being asked of them. For example, even after clearly demonstrating comprehension of the command *levántate* (stand up), students may be tired and not want to stand up or have some other reason for not wanting to participate and would thus need additional prompts from myself or the assistants to comply and stand up. These additional prompts could be done in the L2, though sometimes extra support was needed from the L1 to ensure compliance.

Proximity control may be needed for those students who need extra support paying attention, visually attending to the focal point of activity, or who may occasionally engage in activities such as knocking down chairs. Such children needed an adult nearby to help redirect them when necessary or prevent them from engaging in disruptive or destructive behavior. Additionally, sensory support such as pressure massages, some kind of fidget, or going for walks may be needed for those children who need extra stimulation to stay engaged or need additional breaks. Finally, students may need help properly expressing their needs or desires in class. For example, one student would often interrupt with "No, no, no! Wait, wait, wait!" and would need reminders of how to address me by name to get my attention and express his desires.

Content support is needed when students do not understand the L2 being used in class well enough to follow instructions, respond properly, or engage in an activity in class. Content support consists of signs or gestures, modeling, pauses and repetition, occasional use of the L1, and hands on help completing difficult tasks. One of the most effective forms of content support for students with DS in the FL classroom is the use of signs and gestures. When students do not understand the use of verbal input alone, the addition of the sign, especially when it has been presented and used previously in tandem with the verbal input, is often sufficient to help the student understand. For example, when being told to touch the turtle on the screen if the student does not understand the verbal input alone, the addition of the sign for turtle will add meaning to the verbal input and help them understand. Modeling is helpful when introducing a word or concept for the first time or when giving instructions to students. For example, when instructing students to stand up, the action can be modeled in tandem with the verbal input. When giving instructions, especially more complex instructions, modeling is often needed for the students to be able to comprehend what is required of them. Modeling is also helpful to help students complete complex tasks such as acting out a story with manipulatives. For example, more students experienced success in acting out the story with manipulatives when I had my own set of manipulatives and modeled while narrating the story as opposed to narration alone or narration coupled with pointing to pictures.

Sometimes students simply need extra time to process, and a pause or repetition is sufficient scaffolding to aid them in understanding. A pause gives them additional processing time, and repetition allows them to hear the word again for further processing. At times, however, the use of gestures, modeling, or repetition may not be sufficient to ensure understanding, and the L1 may be necessary to clarify the meaning of more complicated language. Finally, some students needed hands-on help to complete difficult or complex tasks. For example, some children needed support to point to the color on the page while listening to the color song. Another complex task which some students consistently needed hands-on support completing was acting out the story with manipulatives. Some students needed a teacher to help them move the manipulatives in a way which reflected the narration of the story. For example, if I narrated "*el mono se pone el sombrero*," (the monkey puts on the hat), a student may need assistance helping their monkey put on the hat. However, it was not always clear if support for these tasks was needed due to non-comprehension of the language, the complexity of the task, difficulty attending to the task, or a dislike for the activity. It should be noted that many of these content support strategies do not differ from what would benefit a TD child in the FL classroom, though students with DS may need support with more frequency. However, no data is available as to the amount of support needed by a child with DS compared to a TD child since no TD children participated in the study.

The fifth sub-question asks, "What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?" Children with DS seem to enjoy a wide variety of activities in the FL classroom. Activities which involved movement, interaction, or taking a turn were favorites of most students. Additionally, many students enjoyed story time. Though some students struggled to maintain attention for the duration of the story, many students expressed a positive attitude toward story time and would interact verbally during the story. Students especially enjoyed story time when it incorporated physical movement. For example, if a character in the story would run, students could move their feet quickly as if they were running and thus participate in the story. Students enjoyed a variety of activities which allowed them to have their own turn, such as acting out a song or simple story with a prop such as a mask on a stick or coming to the board to point to an animal. Students seemed to enjoy having a turn because it gave them the opportunity not only to participate and move but to show off their skill and receive praise and attention.

Another favorite activity of students was interacting with the monster puppet. Each class began with taking turns guessing which box Monster was sleeping in. After he was found, I would count to three in Spanish and the students would say, "*Hola, Monstruo*" (Hello, Monster). Monster would then proceed to greet every child in the room by name, giving high-fives and hugs. The routine of looking for Monster and greeting Monster quickly became a favorite activity of all the children and the routine became longer and longer as new elements were added to the routine. For example, in the older class, Monster began to eat people's hands and drink their water. The students were constantly coming up with new things for Monster to do, and these new things would then become part of the daily routine. All students were actively engaged in any activity with Monster, even if it was not their turn to greet him, and Monster became an engaging source of rich input in the L2.

The most widely loved activity seemed to be music, especially with a video. Students highly enjoyed the combination of music with movement and benefitted from the visual support given by music videos. Many students had favorite songs and would become visibly excited when a song they liked began to play. Other students expressed their excitement for music by requesting specific songs. Most students were highly engaged during songs with videos which incorporated movement, and many began to sing along to the songs as well.

Research Question 2

The second research question asks, "To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?"

To answer this research question students were administered four post-intervention measures of Spanish vocabulary. Participants were first administered two standardized assessments, followed by two content-based assessments. One of each measured expressive vocabulary and one of each measured receptive vocabulary. The results of the four quantitative assessments of the children with DS only will be discussed below. Additionally, the results of the standardized assessments will be compared to those of the content-based assessments.

EOWPVT-B. The *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (EOWPVT-B) was the standardized assessment used to measure the expressive Spanish vocabulary of intervention participants.[14] Of the ten intervention participants with DS only, only nine participants were administered the EOWPVT-B. The participant who was not administered the EOWPVT-B was also not administered expressive assessments in English due to having unintelligible speech and was given a score of zero. Participants were administered thirty-four items, and scores were calculated as total number correct out of thirty-four. While some participants scored zero, the majority of participants were able to correctly state at least one item in Spanish, with two students achieving five items correct (*M*=1.9; *SD*=2.02). The results for EOWPVT-B can be found on table A3 in appendix 18.

ROWPVT-B. The *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (ROWPVT-B) was the standardized assessment used to measure receptive Spanish vocabulary acquisition of all intervention participants.[15] Thirty-four items were administered, and scores were calculated as total number correct out of thirty-four. All participants correctly identified at least a few items. The minimum number of items correctly identified was four, and the maximum was thirteen (*M*=10.0; *SD*=3.02). The results for ROWPVT-B can be found on table A3 in appendix 18.

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[14] Nancy A. Martin, *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (Novato, CA: Academic Therapy, 2013).

[15] Nancy A. Martin, *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (Novato, CA: Academic Therapy, 2013).

EVCBT. The expressive vocabulary content-based test (EVCBT) was the instrumentation developed in phase 2 to measure the expressive Spanish vocabulary of participants based off of the curriculum used in the Spanish class intervention. The EVCBT was administered to nine of the ten intervention participants with DS only. The one participant who was not administered the EVCBT was also not administered expressive assessments in English due to having unintelligible speech and was given a score of zero. The EVCBT consisted of thirty-five items and scores were calculated as total number correct out of thirty-five. All but two participants correctly produced at least one item in Spanish while the maximum number correctly produced was twenty-seven (M=12.6; SD=9.45).[16] The results for the EVCBT can be found on table A3 in appendix 18.

RVCBT. The receptive vocabulary content-based test (RVCBT) was the instrumentation developed in phase 2 to measure receptive acquisition of Spanish vocabulary from the intervention curriculum. The RVCBT was administered to all intervention participants and consisted of forty-five items. Scores were calculated as total number correct out of forty-five. All participants correctly identified some items in the RVCBT, with the minimum number of items identified being nine, and the maximum forty-one (M=27.8; SD=9.46). The results for the RVCBT can be found on table A3 in appendix 18.

Standardized vs. content-based. Two two-tailed t-tests were conducted to determine the difference in performance between the standardized assessments (EOWPVT-B and ROWPVT-B) and the content-based assessments (EVCBT and RVCBT). One t-test compared the mean percentage correct of the EOWPVT-B to the

[16] Of the two participants who failed to answer at least one item correctly, one was the student who was not administered the assessment. Thus, of those participants administered the assessment, only one was unable to produce at least one word expressively.

mean percentage correct of the EVCBT. Performance on the EVCBT (*M*=36.00; *SD*=27.01) exceeded performance on the EOWPVT-B (*M*=5.59; *SD*=5.96); *t*(18)=3.48, *p*=.003. The second *t*-test compared the mean percentage correct of the ROWPVT-B to the mean percentage correct of the RVCBT. Performance on the RVCBT (*M*=61.78; *SD*=21.03) exceeded performance on the ROWPVT-B (*M*=29.41; *SD*=8.88); *t*(18)=4.48, *p*<.001.

Dual diagnosis vs. DS only

Sub-question A of research question 2 asks, "How does the acquisition of second language vocabulary in a six-week foreign language classroom of children with a dual diagnosis of ASD differ from that of their peers with DS only?" To determine the difference between the acquisition of the students with a dual diagnosis and that of their peers with DS only, each participant with a dual diagnosis was treated as a single case study, with their DS only peers as the control group. Comparisons were made using the program Singlims_ES.exe.[17] Singlims_ES.exe is a modified *t*-test intended to control for an unusually small control group, originally created specifically for neuropsychological case studies.[18] It yields a point estimate to determine whether or not an individual's score is significantly different (abnormal) from that of the controls and provides a

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[17] John R. Crawford, Paul H. Garthwaite, and Sara Porter, "Point and Interval Estimates of Effect Sizes for the Case-Controls Design in Neuropsychology: Rationale, Methods, Implementations, and Proposed Reporting Standards," *Cognitive Neuropsychology*, i*First* (2010): 1–16. Singlims_ES.exe is the updated version of the program Singlims.exe. See J. R. Crawford and Paul H. Garthwaite, "Investigation of the Single Case in Neuropsychology: Confidence Limits on the Abnormality of Test Scores and Test Score Differences," *Neuropsychologia* 40, no.8 (2002): 1196–208.

[18] J. R. Crawford and David C. Howell, "Comparing an Individual's Test Score Against Norms Derived from Small Samples," *The Clinical Neuropsychologist* 12, no. 4 (1998): 482–86. It has been used in various case studies of individuals with DS. See, for example, Margriet A. Groen et al., "A Case of Exceptional Reading Accuracy in a Child with Down Syndrome: Underlying Skills and the Relation to Reading Comprehension," *Cognitive Neuropsychology* 23, no. 8 (2006): 1190–214; Kelly Burgoyne et al., "Bilingualism and Biliteracy in Down Syndrome: Insights from a Case Study," *Language Learning* 66, no. 4 (2016): 945–71; Sarah Martin et al., "Bilingual Outcomes for a Student with Down Syndrome in French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 223–51.

corresponding confidence interval.[19] For example, a point estimate of 7 percent would indicate that 7 percent of the control population would be expected to fall below the score of the individual. An individual's score is considered rare or abnormal when 2.5 percent of the population would be expected to score lower than the individual.[20]

Each participant with a dual diagnosis was compared to the DS only control group for each Spanish vocabulary assessment: EOWPVT-B, ROWPVT-B, EVCBT, and RVCBT, for a total of twelve comparisons. According to the standard of a 2.5 point estimate for significance, no statistically significant differences were found between the participants with a comorbid diagnosis of ASD and the DS only control group on any measurement. All comparisons can be seen on table A4 in appendix 18. In accordance with recommendations, the means and standard deviation of the control group are also reported.[21]

Research Question 3

Research question 3 asks, "Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?" To answer this question results of the EOWPVT-B were compared to results of the ROWPVT-B, and results of the EVCBT were compared to the results of the RVCBT. For the purposes of the analysis between EOWPVT-B and ROWPVT-B raw scores (total correct out of thirty-four) were utilized while percentages of total correct were used for the analysis between EVBCT and RVCBT due to the discrepancy between the number of total assessment items. A two-tailed *t*-test was utilized in both analyses to test the null hypothesis that no significant difference would be

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[19] Crawford and Garthwaite, "Investigation of the Single Case," 1197–98.

[20] Crawford and Garthwaite, "Investigation of the Single Case," 1204.

[21] Crawford, Garthwaite, and Porter, "Point and Interval Estimates," 7.

found between receptive and expressive acquisition. The results of each comparison are presented below.

EOWPVT-B vs. ROWPVT-B. An independent two-tailed *t*-test was conducted using raw scores to determine if there was a difference between the expressive and receptive scores on the standardized assessments. Receptive scores (M=10; SD=3.02) were found to be significantly higher than expressive scores (M=1.9; SD=2.02); $t(18)=7.05$, $p<.001$.

EVCBT vs. RVCBT. An independent two-tailed *t*-test was conducted to determine if there was a difference between the expressive and receptive scores on the content-based assessments. Due to the discrepancy in item numbers, percentages are reported. Receptive scores (M=61.78; SD=21.03) were found to be significantly higher than expressive scores (M=36.00; SD=27.01); $t(18)=2.38$, $p=.028$.

Research Question 4

Research question 4 asks, “which select variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome?” The variables of interest were chronological age, NVC, L1 expressive lexical ability, L1 receptive lexical ability, performance on a NWRT, class attendance, outside exposure to the L2, and maternal education. Chronological age was determined as the age in months at the start of the intervention. NVC was calculated as the raw score on the KBIT-2 administered pre-intervention. L1 abilities were calculated as raw scores on the PPVT-4 and EVT-2 at pre-intervention. Performance on a NWRT was determined by total number correct. Class attendance was total number of classes attended out of total number of classes (thirty). Outside exposure was based on the outside exposure survey and was calculated on a scale from 0 (none) to 3 (high). Finally, maternal education was calculated on a scale of 1 to 5. Means and standard deviations for each variable can be found on table A8 in appendix 21.

Pearson product-moment *r*-correlation coefficients and one-tailed *p*-values were computed to determine the relationship between L2 acquisition and each variable. Pearson *r*-correlations were computed for each of the four assessments. However, due to the lack of variation in the standardized test scores, only *r*-correlations for the EVCBT and RVCBT will be discussed. Statistically significant results, as well as those approaching significance will be discussed. Results of all Pearson *r*-correlations and one-tailed *p*-values can be seen on table A9 in appendix 22.

The following variables did not have a statistically significant relationship to FL lexical acquisition: CA, NVC, class attendance, and outside exposure. The following variables were found to have a statistically significant relationship to at least one measurement of FL lexical acquisition: L1 expressive lexical ability, L1 receptive lexical ability, performance on a NWRT, and maternal education. L1 expressive lexical ability was found to be strongly positively correlated to FL expressive acquisition, $r(8)=.75$, $p=.006$. The relationship between L1 expressive lexical ability and FL lexical acquisition is such that as L1 expressive ability increases, FL expressive acquisition also increases. L1 receptive lexical ability was found to be moderately positively correlated to FL expressive acquisition, $r(8)=.54$, $p=.052$. The relationship between L1 receptive lexical ability and FL lexical acquisition is such that as L1 receptive ability increases, FL expressive lexical acquisition also increases.

Performance on a NWRT was found to be moderately positively correlated to both FL expressive acquisition, $r(8)=.64$, $p=.024$, and FL receptive acquisition, $r(8)=.6$, $p=.033$. The relationship between performance on a NWRT and FL lexical acquisition is such that as performance on the task increases, FL lexical acquisition also increases, with the relationship between performance on a NWRT and FL expressive acquisition slightly stronger than receptive FL acquisition. Maternal education was found to be moderately strongly related to expressive FL acquisition $r(8)=.66$, $p=.019$. The relationship between maternal education and FL lexical acquisition is such that as maternal education increases, so does FL expressive acquisition.

Research Question 5

Research question 5 seeks to determine if L1 vocabulary levels of children with DS change after participation in a six-week FL class as measured by a standardized assessment. The pre- and post-intervention English vocabulary tests were analyzed in two different ways to answer this question. First, the means of the English vocabulary pre- and post-tests were compared using a two-tailed *t*-test. PPVT-4 scores at time one (M=67.2; SD=26.42) did not differ significantly from PPVT-4 scores at time two (M=71.1; SD=28.65); $t(18)=0.32$, p=.755. Likewise, EVT-2 scores at time one (M=49.8; SD=26.81) did not differ significantly from EVT-2 scores at time two (M=53.3; SD=31.29); $t(18)$=.27, p=.791.

Secondly, to determine the change in L1 vocabulary from pre-intervention to post-intervention, the growth scale value (GSV) of each intervention participant was calculated for the PPVT-4, Forms A and B, and EVT-2, Forms A and B. The GSV from Form A was then subtracted from Form B to determine the change. The GSV is “an indicator of the absolute level of performance” and is “designed for measuring change over time,” and thus is the most useful measurement of change for L1 vocabulary from pre-intervention to post-intervention.[22] The means of each GSV change was compared to the measures of significance as provided in the test manuals to determine any significant change.[23] The GSV change of the PPVT-4 (M=2.7; SD= 11.55) did not reach

[22] Lloyd M. Dunn and Douglass M. Dunn, *Peabody Picture Vocabulary Test Manual*, 4th ed. (Minneapolis: NCS Pearson, 2007), 205.

[23] The EVT-2 and PPVT-4 manuals each supply a chart which lists statistically significant difference sizes by age group (p<.10), and state that “a statistically significant difference is one that is large enough to be unlikely to have occurred by chance (i.e., because of measurement error) . . . (though) statistically significant differences are not necessary for demonstrating growth in vocabulary.” Kathleen T.

significance.[24] Likewise, the GSV change of the EVT-2 (*M*=1.7; *SD*= 6.31) did not reach significance.[25] Though the results of the participants with a dual diagnosis are not included in the above statistical analyses, individual results of the GSV change of participants with a dual diagnosis can be seen on table A5 in appendix 18.

Evaluation of Research Design

The following section offers a brief summary of the strengths and weaknesses of this exploratory mixed methods multiple case study design. This study offered many valuable contributions to the study of second language acquisition in children with DS even though the final design was not precisely as originally intended.[26]

Strengths of the Research Design

This study was the first to document the L2 acquisition of children with DS with or without a comorbid diagnosis of ASD in the FL context and their participation in the FL classroom, and as such is an important contribution to the fields of second language acquisition and language development in children with DS. The first strength of

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Williams, *The Expressive Vocabulary Test Manual*, 2nd ed. (Minneapolis: NCS Pearson, 2007), 221 and Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 205.

[24] For the age range of the intervention participants, a GSV change of 8 points is needed to reach significance (p<.10). Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 205. It should be noted that the PPVT-4 manual states that the average GSV is a meaningful way to measure the progress of groups, though "the size of a difference required for statistical significance is smaller for group averages than for individual scores." Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 206. Though the manual does not provide the size of a difference required for statistical significance for a group, it is likely that the mean of the GSV change for neither the PPVT nor the EVT would reach statistical significance by such a measure, as both averages are less than half of what is required for statistical significance for individuals.

[25] For the age range of the intervention participants, a GSV change of 7 points is needed to reach significance (p<.10). Williams, *The Expressive Vocabulary Test Manual*, 221.

[26] More details regarding the original design of the study and the obstacles faced to complete the study can be found in chapter 5 under the heading "Obstacles to Conducting the Research." Many of the strengths and weaknesses mentioned in this present section are discussed in more detail in said section in chapter 5.

this study is the variety of abilities represented among the intervention participants. Though it is not possible to claim that the entire spectrum of abilities represented in individuals with DS was represented in this sample, a wide variety of cognitive and linguistic abilities were represented among the intervention participants, including individuals with a dual diagnosis of ASD. Additionally, the multiple case study design was a strength for this study as it provided a rich description of the participation of children with DS in the FL classroom. The multiple case studies presented represent children with a wide spectrum of cognitive and linguistic abilities with varying experiences in the FL classroom.

The unique setting of the intervention at the summer enrichment camp at DSL contributed to various strengths of the study. First, as a result of the six-week setting, the frequency of exposure to the L2 was greater than would have been in another setting, such as in an elementary school classroom. The daily exposure to the L2 was likely advantageous for the acquisition of intervention participants. Secondly, the unique setting in a camp exclusively for children with DS allowed many children with DS to be exposed to the same L2 input at the same time. A different design that gathered data from distinct sources or contexts would not provide a consistent base of L2 input for which to compare the acquisition of participants.

Next, the exploratory design of this study allowed for the development of instrumentation specific to the L2 input received by the students. This provided a more accurate representation of the L2 acquisition of the intervention participants which would not have been possible if relying solely upon standardized assessments. Finally, the mixed methods design of this study which combined both quantitative and qualitative data on the L2 acquisition of children with DS in the FL context provides a much richer and fuller understanding of initial stages of FL acquisition in children with DS than either source could have provided independently.

Weaknesses of the Research Design

Despite the uniqueness of this research, the design had some notable weaknesses, the first of which is the lack of a TD control group. Though efforts were made to recruit TD students to participate in the Spanish intervention, none committed to participating. As a result, the acquisition of the children with DS cannot be compared to TD students who received the same or comparable input. While the data collected from the children with DS is valuable in and of itself, more would be understood about their acquisition if it could be compared to that of TD children. Another weakness of the study is the small L1 control group, which consisted of only three individuals. As a result of the small control group, the data gathered was not utilized in the final analysis. The conclusions drawn regarding the impact of exposure to a FL on L1 vocabulary could be considered more reliable if compared to a control group. The conclusions drawn regarding change in L1 vocabulary may also be more reliable had the same form of the PPVT-4 and the EVT-2 been used in the pre- and post-intervention assessments. Furthermore, the small sample size may have resulted in insufficient power for some tests of significance, such as those which measured correlations between variables and acquisition.

Additionally, most participants would have benefitted from multiple pre- and post-intervention assessment sessions, but this was not feasible due to scheduling and time constraints. Had participants been able to complete their assessments over a span of two sessions rather than one, they may have demonstrated more acquisition. Finally, the length of exposure to the L2 was quite limited, totaling about twenty-two and a half hours of exposure. Due to the short nature of this study students had limited contact with the L2, and a more long-term study with a greater amount of exposure to the L2 would reveal more about the initial stages of L2 acquisition in the FL context among children with DS.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Research Purpose

The purpose of this study was to describe the participation of elementary-aged children with DS with and without a comorbid diagnosis of ASD in a six-week FL class and to measure the receptive and expressive lexical acquisition of Spanish as a FL in students with DS. This study also examined the variables which correlate with FL lexical acquisition in children with DS and the effect of FL exposure upon L1 vocabulary of children with DS.

Research Questions

The following questions were addressed by this study:

1. How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?
    a. How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?
    b. How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?
    c. What barriers exist to their participation in the foreign language classroom?
    d. What type of support do children with Down syndrome need to successfully participate in the foreign language classroom?
    e. What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?
2. To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?

a. How does the acquisition of second language vocabulary in a six-week foreign language classroom of children with a dual diagnosis of ASD differ from that of their peers with DS only?

3. Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?

4. Which select variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome?

5. Do L1 vocabulary levels of children with Down syndrome change over the course of a six-week FL class as measured by a standardized assessment?

Discussion of Findings

The analysis of findings for each research question was presented in chapter 4. The below section will discuss the significance of the findings for each research question. Special attention will be given to those findings with statistical significance and will interact with relevant precedent literature.

Research Question 1

The first research question drew upon qualitative data to explore how students with DS with or without a comorbid diagnosis of ASD demonstrate their acquisition of the Spanish language in a six-week FL classroom. The sub-questions examined how students with DS demonstrate comprehension and non-comprehension of the L2, what barriers exist to their participation in class and accordingly, what type of support they need to successfully participate in the class, and finally, what activities they seem to enjoy the most in the FL classroom. The answers to these questions are valuable for any teacher wishing to teach a FL to children with DS, whether in a segregated context, similar to that of this study, or in the inclusive context alongside TD peers.

Students with DS demonstrate non-comprehension of the L2 through facial expressions and body language, hesitancy in responding to instructions or non-response to instructions or questions, incorrect responses, and direct statements of non-comprehension. Students with DS demonstrate comprehension of the L2 in the FL classroom through a variety of responses, both nonverbal and verbal. Nonverbal responses which demonstrate understanding of the L2 include appropriate facial expressions and body language, the use of signs and gestures, following instructions, responding correctly to prompts, responding with the proper actions, and acting out what is being narrated. Verbal indicators of comprehension of the L2 include interacting in the L1, answering questions verbally in the L1 or L2, and singing along to songs. These indicators of non-comprehension and comprehension demonstrate that children with DS can comprehend the L2 in the FL classroom, though they may need some support to understand. Overall, when given ample support and scaffolding in the form of simple language, gestures and signs, pictures, or modeling, students with DS are able to understand much of the L2 in a novice FL class. Teachers of children with DS should be aware of the signs of comprehension and non-comprehension so that they can adequately adjust their language and delivery of the L2 and make it comprehensible for students with DS.

While students with DS can successfully participate in the FL classroom, some barriers do exist to their participation, and as a result they may need the support of an assistant or the teacher to be fully integrated into the classroom. Barriers to the participation of children with DS in the FL classroom may be divided into internal and external barriers, though the delineation between the two is not always clearcut and the two often intermingle or feed off of each other. Internal barriers include short attention span, difficulty attending to relevant people and stimuli (especially for those students with a dual diagnosis), sensory needs, mood and energy level, and behavior. External barriers include changes in schedules, distraction from a preferred object, difficulty understanding instructions or complex language and activities, and distracting or disruptive behavior from other students. The extent to which a child with DS may be affected by any one of these barriers varies greatly among individuals. The most widespread and formidable barrier seemed to be behavior, whether the child’s own behavior or the disruptive behavior of another child. It is important to note that many of these barriers can easily be avoided or lessened by providing the proper scaffolding and support to students and thus in some sense should not be considered barriers but challenges. That is to say that the vast majority of these challenges can be overcome and children with DS can indeed successfully participate in the FL classroom.

As a result of these challenges, some children with DS may need support from an assistant or the teacher to fully participate in the FL classroom. The amount of support needed to successfully participate in the FL classroom varies widely among students with DS and may be divided into two broad categories: behavioral support and content support. Behavioral support needed to participate in the FL classroom includes verbal reminders, proximity control, sensory support, and support properly expressing needs or desires. Behavioral support is more closely related to child internal factors and thus may be needed by children with DS in any classroom context. Content support is related to the child's ability to understand the L2 and participate in activities involving the L2 in the FL classroom and consists of signs or gestures, modeling, pauses and repetition, occasional use of the L1, and hands on help completing difficult tasks.

It should be noted that many of these content support strategies do not differ from what would benefit a TD child in the FL classroom, though students with DS may need support with more frequency. However, no data is available as to the amount of support needed by a child with DS as compared to a TD child since no TD children participated in the study. While some students with DS require fairly consistent support from an assistant to participate fully in the FL classroom, other students with DS are able to participate independently without extra support from an assistant. Additionally, most students increased in their ability to participate independently in the FL classroom throughout the duration of the course, indicating an increase in comprehension and possible acquisition of the Spanish language.

Finally, children with DS seemed to enjoy a wide variety of activities in the FL classroom. While enjoyment of an activity does not guarantee acquisition, little acquisition is likely to take place without enjoyment, as students are less likely to engage in activities which they do not enjoy, and therefore not receive the Spanish input, a prerequisite for acquisition. Activities which involved movement, interaction, or taking a turn were favorites of most students. Though sustaining attention through the duration of story time was challenging for some students, many seemed to enjoy story time. Students especially enjoyed looking for the monster puppet every class and the accompanying greeting routine. Finally, most students truly enjoyed any activity involving music, especially when accompanied by movement and a video. There is no shortage of input rich activities which may be used to facilitate L2 learning by children with DS in the FL classroom.

Research Question 2

The second research question examined to what extent children with DS could acquire L2 vocabulary in the FL classroom. The results of the quantitative assessments clearly demonstrate that children with DS can acquire L2 vocabulary in a six-week FL classroom. All children who participated in the intervention showed evidence of vocabulary acquisition as measured by a quantitative assessment. Four quantitative measures were administered to intervention participants, with varying results.

As expected, participants performed significantly higher on the content-based assessments (EVCBT and RVCBT) than the standardized assessments (EOWPVT-B and ROWPVT-B). The disparity between the standardized assessments and the content-based assessments is evident when comparing the percentage of total items correctly answered. While participants correctly answered 36 percent of the items on the EVCBT (SD=27.01), they only correctly answered 5.59 percent of the items on the EOWPVT-B (SD=5.96); $t(18)=3.48$, $p=.003$. Similarly, while participants correctly answered 61.78 percent of items on the RVCBT (SD=21.03), they only correctly answered 29.41 percent of the items on the ROWPVT-B (*SD*=8.88); *t*(18)=4.48, *p*<.001. Despite the sizable gaps in performance between the content-based assessments and the standardized assessments, many participants were able to demonstrate a small amount of acquisition as measured by the standardized assessments. All students demonstrated receptive L2 vocabulary acquisition as measured by the standardized assessment (*M*=10.00; *SD*=3.02) and by the content-based assessment (*M*=27.8; *SD*=9.46). Eight students correctly identified at least half of the items on the RVCBT and one student correctly identified forty-one items (91.11 percent), demonstrating that many students were able to achieve a considerable level of success acquiring receptive vocabulary after only six weeks of instruction.

Given the distinct expressive deficit experienced by children with DS, the slow nature of L2 acquisition, and the limited contact with the L2, skepticism was expressed as to the possibility of participants acquiring expressive L2 vocabulary. Despite these various factors, the majority of participants (80 percent) acquired at least some expressive L2 vocabulary as measured by the EOWPVT-B (*M*=1.9, *SD*=2.02) and by the EVCBT (*M*=12.6; *SD*=9.45). Four students correctly stated at least half of the items on the EVCBT, and one student correctly stated twenty-seven items (77.14 percent), demonstrating that some children with DS can successfully acquire a considerable amount of expressive FL vocabulary in a relatively brief amount of time.

When presented with the question, "Can individuals with Down syndrome become second language learners?" in 2009 Kay-Raining Bird responded, "The answer is probably. There are currently no studies of bilingualism in children with DS that have focused specifically upon second language learners."[1] Since that time, a small amount research has been conducted on L2 learning in children with DS, though not in the FL

[1] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," *Perspectives on Language Learning and Education* 16, no. 3 (2009): 93.

context.[2] This research demonstrates that children with DS can indeed acquire both receptive and expressive L2 vocabulary in a six-week FL class to varying degrees of success.

Sub-question A of research question 2 seeks to determine how the acquisition of second language vocabulary in a six-week foreign language classroom of children with a dual diagnosis of ASD differs from that of their peers with DS only. After six weeks of Spanish instruction, the acquisition of the participants with a dual diagnosis was on par with that of their peers with DS only. All students with a comorbid ASD diagnosis demonstrated receptive acquisition, and of the twelve comparisons made between the dual diagnosis participants and the DS only control group, no participant with a comorbid diagnosis was found to have a rare or abnormal score. In some cases of receptive acquisition, the dual diagnosis participants scored above the mean of the DS control group (though not in a statistically significant way).

While no statistically significant difference was found between the dual diagnosis participants and the DS only control group in the expressive mode, it is probable that given a longer intervention period a difference would be found, at least between DD1 and DD3, as they are both nonverbal.[3] No significant difference in expressive acquisition was found after only six weeks as the DS only participants also scored very low on the expressive assessments, likely due to the short amount of intervention time and the impaired nature of expressive language in individuals with DS. While verbal participants with DS only would likely begin to acquire more expressive

[2] Sarah Martin and colleagues conducted a single case study of L2 learning in a child with DS in the immersion context. Sarah Martin et al., "Bilingual Outcomes for a Student with Down Syndrome in French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 1–29. To date no other studies on L2 learning in children with DS have been published.

[3] Though DD1 and DD3 are considered nonverbal, they do utter occasional one-word utterances. Though not captured through the assessments, DD1 would often say "*luz*" (light) and "*nariz*" (nose) in the correct context.

vocabulary in Spanish given further intervention, DD1 and DD3 would most likely continue to receive a score of zero on the expressive assessments, eventually resulting in a statistically significant difference.

These results align with those found by Ward and Sanoudaki in their analysis of the language skills of English-Welsh bilingual children with a comorbid diagnosis of ASD. Ward and Sanoudaki utilized a similar statistical method to compare each dual diagnosis participant to control groups of monolingual and bilingual children with DS only and found that the children with DS and comorbid ASD "performed comparably to the children with DS on receptive and expressive language in English and receptive vocabulary in Welsh."[4] Together the results of these two studies demonstrate that children with DS with a comorbid ASD diagnosis are able to become bilingual and begin learning a second language in the FL context on par with their peers with DS only.

Research Question 3

The third research question asked whether the post-intervention L2 expressive vocabulary skills differed from post-intervention L2 receptive vocabulary skills. The raw data demonstrates that the post-intervention Spanish expressive and receptive lexical abilities of all intervention participants differ, with L2 receptive abilities exceeding expressive for every participant. This difference was found to be statistically significant. As a group participants scored higher on measurements of receptive vocabulary than measurements of expressive vocabulary ($t(18)=3.93$, $p<.001$), though the difference between expressive and receptive abilities was more salient on the standardized assessments ($t(18)=7.05$, $p<.001$) than the content-based assessments ($t(18)=2.38$, $p=.028$).

These results conform to what would be expected given that individuals with

[4] Rebecca Ward and Eirini Sanoudaki, "Bilingualism in Children with a Dual Diagnosis of Down Syndrome and Autism Spectrum Disorder," *Clinical Linguistics & Phonetics* 35, no. 7 (2021): 679.

DS have a marked delay in expressive abilities when compared to receptive abilities.[5] The receptive vocabulary of individuals with DS generally surpasses that of their expressive vocabulary so that they tend to understand more words than they can speak, and receptive vocabulary is considered a relative strength for individuals with DS.[6] This holds true for monolinguals as well as for bilinguals in both their dominant and non-dominant language.[7] Additionally, research on novel word acquisition demonstrates that when exposed to new words individuals with DS are able to comprehend much more than they can produce.[8] Thus, it seems reasonable to conclude that FL acquisition in children with DS may follow the same general pattern of language abilities in individuals with DS in that receptive abilities precede expressive abilities. When learning a FL, as with an L1, receptive vocabulary may be considered a relative strength for individuals with DS.

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[5] Julie Grieco et al., "Down Syndrome: Cognitive and Behavioral Functioning across the Lifespan," *American Journal of Medical Genetics Part C: Seminars in Medical Genetics*, 169, no. 2 (2015): 136; Leonard Abbeduto, Steven F. Warren, and Frances A. Conners, "Language Development in Down Syndrome: From the Prelinguistic Period to the Acquisition of Literacy," *Mental Retardation and Developmental Disabilities Research Reviews* 13, no. 3 (2007): 250; Gary E. Martin et al., "Language Characteristics of Individuals with Down Syndrome," *Topics in Language Disorders* 29, no. 2 (2009): 5; Glynis Laws and Dorothy V. M. Bishop, "A Comparison of Language Abilities in Adolescents with Down Syndrome and Children with Specific Language Impairment," *JSLHR* 46, no. 6 (2003): 1335; Robin S. Chapman et al., "Language Skills of Children and Adolescents with Down Syndrome: II. Production Deficits," *JSLHR* 41, no. 4 (1998): 9.

[6] For receptive vocabulary as a relative strength in individuals with DS, see Glynis Laws et al., "Receptive Vocabulary and Semantic Knowledge in Children with SLI and Children with Down Syndrome," *Child Neuropsychology* 21, no. 4 (2015): 498, 502; Miguel Galeote et al., "The Development of Vocabulary in Spanish Children with Down Syndrome: Comprehension, Production, and Gestures," *Journal of Intellectual and Developmental Disability* 36, no. 3 (2011): 191–93.

[7] For bilinguals see Rebecca Ward and Eirini Sanoudaki, "Language Profiles of Welsh-English Bilingual Children with Down Syndrome," *JOCD* 93 (2021):10–11; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 92; Krista Feltmate and Elizabeth Kay-Raining Bird, "Language Learning in Four Bilingual Children with Down Syndrome: A Detailed Analysis of Vocabulary and Morphosyntax," *Canadian Journal of Speech-Language Pathology and Audiology* 32, no. 1, (2008): 15–16; Elizabeth Kay-Raining Bird et al., "The Language Abilities of Bilingual Children with Down Syndrome," *AJSLP* 14, no. 3 (2005): 295–96.

[8] See, for example, Elizabeth Kay-Raining Bird et al., "Novel Word Acquisition in Children with Down Syndrome: Does Modality Make a Difference?," *JOCD* 33, no. 3 (2000): 258.

Research Question 4

Research question 4 sought to determine which factors relate to FL vocabulary acquisition. The variables examined were CA, NVC, L1 expressive lexical ability, L1 receptive lexical ability, performance on a NWRT, class attendance, outside exposure to the L2, and maternal education. Four variables were found to be significantly related to some aspect of FL acquisition. These variables in order of strength are L1 expressive ability, maternal education, performance on a NWRT, and L1 receptive ability. These variables and the pertinent literature will be discussed below. Due to their link to each other in the literature, L1 receptive and expressive abilities will be discussed simultaneously.

Maternal education, $r(8)=.66$, $p=.019$, was moderately strongly positively correlated to expressive FL vocabulary acquisition such that as maternal education increased, FL expressive vocabulary increased. The expected relationship of maternal education to vocabulary acquisition in L2 learners with DS is not completely clear from the literature. While maternal education seems to be a significant factor in receptive and expressive vocabulary acquisition for TD bilingual and L2 learners, the relationship between maternal education and vocabulary development for children with DS is more ambiguous.[9] In their studies on boys with DS, Price and colleagues found that maternal education predicts receptive language and Roberts and colleagues found that higher

[9] For TD children see Johanne Paradis, "Oral Language Development in French and English and the Role of Home Input Factors" (report presented at the Conseil scolaire Centre-Nord Edmonton, Alberta, Canada, April, 2009); Heather Golberg, Johanne Paradis, and Martha Crago, "Lexical Acquisition over Time in Minority First Language Children Learning English as a Second Language," *Applied Psycholinguistics* 29, no. 1 (2008): 59. In another study, Paradis found maternal education to be a marginally significant factor, as opposed to a highly significant factor, in L2 vocabulary acquisition. Johanne Paradis, "Individual Differences in Child English Second Language Acquisition: Comparing Child-Internal and Child-External Factors," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 225–28. However, Rydland and colleagues found maternal education to be the sole factor in the rate of L2 growth in the elementary years of Turkish immigrants in Norway. Veslemøy Rydland, Vibeke Grøver, and Joshua Lawrence, "The Second-Language Vocabulary Trajectories of Turkish Immigrant Children in Norway from Ages Five to Ten: The Role of Preschool Talk Exposure, Maternal Education, and Co-Ethnic Concentration in the Neighborhood," *Journal of Child Language* 41, no. 2 (2014): 352–81.

maternal education resulted in higher vocabulary abilities.[10] However, Cuskelly and colleagues did not find an influence of maternal education on receptive vocabulary in monolingual children with DS and posit that the "cognitive and language deficits associated with the condition may overwhelm (the) external influence" of maternal education typically found in TD children.[11] Additionally, studies in language development in bilingual children with DS have yet to find a link between maternal education and language development.[12] However, Kay-Raining Bird mentions that mothers with higher education tend to have children with more exposure to the L2 and thus greater gains in L2 acquisition, suggesting a mediated effect of maternal education on L2 acquisition in children with DS via exposure to the L2.[13] Such a mediated effect is doubtful in this study, however, since outside exposure to the language was not a significant factor in FL vocabulary acquisition.

Despite a lack of clear evidence for a connection between maternal education and lexical abilities in children with DS, this study demonstrated a connection between

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[10] J. Price et al., "Language Comprehension in Boys with Fragile X Syndrome and Boys with Down Syndrome," *JIDR* 51, no. 4 (2007): 322; Joanne Roberts et al., "Receptive Vocabulary, Expressive Vocabulary, and Speech Production of Boys with Fragile X Syndrome in Comparison to Boys with Down Syndrome," *AJMR* 112, no. 3 (2007): 186–89.

[11] Monica Cuskelly, Jenny Povey, and Anne Jobling, "Trajectories of Development of Receptive Vocabulary in Individuals with Down Syndrome," *Journal of Policy and Practice in Intellectual Disabilities* 13, no. 2 (2016): 117. Expressive vocabulary was not examined in this study, thus no claims can be made off of this study as to the effect of maternal education on expressive vocabulary in individuals with DS. For no relationship between language development in children or infants with DS and maternal education, see Robin S. Chapman et al., "Predicting Language Production in Children and Adolescents with Down Syndrome: The Role of Comprehension," *JSLHR* 43, no. 2 (2000): 340–50; Peter Mundy et al., "Nonverbal Communication and Early Language Acquisition in Children with Down Syndrome and in Normally Developing Children," *JSLHR* 38, no. 1 (1995): 160.

[12] Natacha Trudeau et al., "Développement lexical chez les enfants bilingues avec Trisomie 21," *Enfance* 3, no. 3 (2011): 392. Ward and Sanoudaki found no relationship between socioeconomic status (of which maternal education was one factor) and language abilities in bilingual children with DS. Ward and Sanoudaki, "Language Profiles," 10–11. Likewise, Feltmate and Kay-Raining Bird found no connection between parental education and language development in bilingual children with DS. Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 16.

[13] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 92.

expressive lexical L2 abilities in the FL context and maternal education. This link may be due to the small size of the study sample, the limited amount of time of the study, or the extreme sensitivity of expressive abilities in children with DS. The lack of mention or ambiguity of the role of maternal education as a significant factor in vocabulary acquisition of children in DS may indicate the need for further research in this area.[14] The findings from this study are in no way conclusive and this factor should continue to be investigated.

Performance on a NWRT was found to be moderately correlated to both receptive ($r(8)=.6$, $p=.033$) and expressive ($r(8)=.64$, $p=.024$) L2 lexical acquisition, with a slightly stronger relationship between L2 expressive than receptive acquisition. Thus, higher performance on the NWRT correlated to higher L2 vocabulary acquisition, both expressive and receptive. The connection between performance on a NWRT and L2 vocabulary acquisition is not surprising given that there is a robust link between phonological memory, of which NWRT is a measure, and L2 development in TD individuals, as well as L1 development in individuals with DS.[15]

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[14] For example, Katsarou and Andreou did not examine the effect of parental education in their study of language development of bilingual children with DS. Dimitra Katsarou and Georgia Andreou, "Bilingualism in Down Syndrome: A Greek Study," *International Journal of Disability, Development and Education* 68, no. 3 (2021): 5. Kay-Raining Bird and colleagues did not find that parental education was a significant factor in L2 ability among children of DS. However, parental education did not differ between three of the four groups, possibly impacting the outcome of the relationship found between L2 ability and parental education. Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 190. For similar situations see Elena Checa, Miguel Galeote, and Pilar Soto, "The Composition of Early Vocabulary in Spanish Children with Down Syndrome and Their Peers with Typical Development," *AJSLP* 25, no. 4 (2016): 614, and Leonard Abbeduto et al., "Collaboration in Referential Communication: Comparison of Youth with Down Syndrome or Fragile X Syndrome," *AJMR* 111, no. 3 (2006): 172.

[15] For L2 development in TD children, see Lia Efstathiadi, "Early Foreign Language Learning: Intensive Exposure, Vocabulary Development and the Cognitive Skills Involved," *Belgrade English Language and Literature Studies* 11, no. 1 (2019): 95–96; Thomai Alexiou, "Young Learners' Cognitive Skills and their Role in Foreign Language Vocabulary Learning," in *Early Learning of Modern Foreign Languages: Processes and Outcomes*, ed. Marianne Nikolov (Bristol, UK: Multilingual Matters, 2009), 55–56; Johanne Paradis, "Individual Differences in Child English Second Language Acquisition," 229. For L1 development in individuals with DS, see Robin S. Chapman, Linda J. Hesketh, and Doris J. Kistler, "Predicting Longitudinal Change in Language Production and Comprehension in Individuals with Down

More specifically, phonological memory seems to be a significant predictor of vocabulary acquisition in individuals with DS.[16] Majerus and Barisnikov found a strong relationship in monolinguals with DS between phonological memory and receptive vocabulary though no association between phonological memory and expressive vocabulary.[17] Ward and Sanoudaki found phonological memory to be the strongest predictor of receptive language in bilingual children with DS.[18] Similarly, of those factors explored in this study, phonological memory was the only factor moderately correlated to FL receptive vocabulary acquisition. However, unlike the results of Majerus and Barisnikov which found no association between phonological memory and expressive vocabulary, this study found a moderate connection between phonological memory as measured by a NWRT to both receptive and expressive FL vocabulary, with a marginally stronger relationship to expressive vocabulary.

Despite the connection between the performance on the NWRT and FL vocabulary acquisition, even children who were unable to complete the NWRT or scored

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Syndrome: Hierarchical Linear Modeling," *JSLHR* 45, no. 5 (2002): 902–15; Robin S. Chapman and Linda J. Hesketh, "Language, Cognition, and Short-Term Memory in Individuals with Down Syndrome," *DSRP* 7, no. 1 (2001): 3–4; Glynis Laws, "The Use of Nonword Repetition as a Test of Phonological Memory in Children with Down Syndrome," *Journal of Child Psychology and Psychiatry and Allied Disciplines* 39, no. 8 (1998): 1119–30.

[16] Glynis Laws and Deborah Gunn, "Phonological Memory as a Predictor of Language Comprehension in Down Syndrome: A Five-Year Follow-up Study," *Journal of Child Psychology and Psychiatry* 45, no. 2 (2004): 333–34. Jarrold and colleagues argue that "verbal short-term memory drives vocabulary acquisition." Christopher Jarrold, Alan D. Baddeley, and Caroline E. Phillips, "Verbal Short-Term Memory in Down Syndrome: A Problem of Memory, Audition, or Speech?," *JSLHR* 45 (2002): 538. However, Kari-Anne B. Næss and colleagues found no evidence of a longitudinal predictive relationship between VSTM and vocabulary development. Kari-Anne B. Næss et al., "Longitudinal Relationships between Language and Verbal Short-Term Memory Skills in Children with Down Syndrome," *Journal of Experimental Child Psychology* 135 (2015): 52.

[17] Steve Majerus and Koviljka Barisnikov, "Verbal Short-Term Memory Shows a Specific Association with Receptive but Not Productive Vocabulary Measures in Down Syndrome," *JIDR* 62, no. 1 (2018): 10–20.

[18] Rebecca Ward and Eirini Sanoudaki, "Language Profiles of Welsh-English Bilingual Children with Down Syndrome," *JOCD* 93 (2021): 11–12.

very low were able to acquire some FL vocabulary. This may suggest, as Mosse and Jarrold posit, that novel word-learning in children with DS is not completely inhibited by deficits in phonological memory and therefore must be supported by some type of domain general capacity.[19] However, this conclusion cannot be fully supported based off of the available data from this study as there was no TD control group. More studies are needed of L2 acquisition in the FL context to clarify the relationship between L2 acquisition and phonological memory in children with DS.

L1 receptive lexical ability as assessed by the PPVT-4 was found to be moderately correlated to expressive FL vocabulary acquisition ($r(8)=.54$, $p=.052$), such that as L1 receptive abilities increased so too did FL expressive lexical acquisition. L1 expressive lexical ability as assessed by the EVT-2 was also found to be a significant factor in FL expressive acquisition and was strongly correlated to FL expressive lexical acquisition ($r(8)=.75$, $p=.006$). The relationship between expressive FL vocabulary acquisition and L1 lexical ability, particularly L1 expressive lexical ability was highly significant, such that those students with higher L1 lexical abilities acquired more expressive FL vocabulary than those students with lower L1 lexical abilities.

In studies on second language acquisition in TD children, L1 abilities have been shown to be a significant factor in L2 acquisition, so much so that L2 abilities seem to mirror L1 abilities.[20] This same pattern seems to appear in bilingual children with DS, in that the abilities in the weaker language reflect those in the stronger language.[21] The

[19] Emma K. Mosse and Christopher Jarrold, "Evidence for Preserved Novel Word Learning in Down Syndrome Suggests Multiple Routes to Vocabulary Acquisition," *Journal of Speech, Language and Hearing Research* 54, no. 4 (2011): 1137–52.

[20] Richard L. Sparks, Jon Patton, and Julie Luebbers, "Individual Differences in L2 Achievement Mirror Individual Differences in L1 Skills and L2 Aptitude: Crosslinguistic Transfer of L1 to L2 Skills," *Foreign Language Annals* 52, no. 2 (2019): 255–83; Richard Sparks et al., "Long-Term Crosslinguistic Transfer of Skills from L1 to L2," *Language Learning* 59, no. 1 (2009): 203–43.

[21] Trudeau et al., "Développement lexical chez les enfants," 391; Ward and Sanoudaki, "Language Profiles," 11; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196–97.

link between L1 vocabulary and L2 abilities is particularly strong and among other skills is related to L2 vocabulary acquisition in TD children.[22] In bilingual children with DS, receptive vocabulary skills in the dominant language strongly correlate to receptive vocabulary in the weaker language.[23] However, in this study no such relationship was found. Rather, receptive L1 vocabulary correlated to L2 expressive skills. This may be due to the short-term nature of this study in the FL context rather than the bilingual context or the small sample size which may have resulted in insufficient power to detect a correlation. Among children with DLD, though the relationship between L1 and L2 is not as strong as in TD children, research demonstrates that the relationship between L1 and L2 skills increases as the child increases in proficiency in both languages.[24] To discover whether a similar pattern exists among FL acquisition in children with DS a more long-term study would be needed.

Kay-Raining Bird suggests that stronger language ability may support learning in the weaker language in bilingual children with DS and this is likely the case in L2 learning in the FL context as well.[25] Though it has been suggested that L1 abilities may

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[22] Vibeke Grøver, Joshua Lawrence, and Veslemøy Rydland, "Bilingual Preschool Children's Second-Language Vocabulary Development: The Role of First-Language Vocabulary Skills and Second-Language Talk Input," *International Journal of Bilingualism* 22, no. 2 (April 2018): 234–50; Larry Vandergrift and Susan Baker, "Learner Variables in Second Language Listening Comprehension: An Exploratory Path Analysis," *Language Learning* 65, no. 2 (2015): 407, 410; Anne-Catherine Nicolay and Martine Poncelet, "Cognitive Abilities underlying Second-Language Vocabulary Acquisition in an Early Second-Language Immersion Education Context: A Longitudinal Study," *Journal of Experimental Child Psychology* 115, no. 4 (2013): 664; Melissa Koenig and Amanda L. Woodward, "Toddlers Learn Words in a Foreign Language: The Role of Native Vocabulary Knowledge," *Journal of Child Language* 39, no. 2 (2012): 1–13.

[23] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 194.

[24] Elena Tribushinina, Elena Dubinkina-Elgart, and Nadezhda Rabkina, "Can Children with DLD Acquire a Second Language in a Foreign-Language Classroom? Effects of Age and Cross-Language Relationships," *JOCD* 88 (2020): 14–15. Blom and Paradis found that children with SLI cannot make use of L1 transfer as efficiently as TD children. Elma Blom and Johanne Paradis, "Sources of Individual Differences in the Acquisition of Tense Inflection by English Second Language Learners with and without Specific Language Impairment," *Applied Psycholinguistics* 36, no. 4 (2015): 971–73.

[25] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in

not play any significant role in L2 acquisition until after a considerable amount of L2 exposure, it appears that it may be a significant factor in FL vocabulary acquisition in children with DS even in the earliest stages of L2 acquisition.[26] This study demonstrated that after only six weeks of L2 instruction, L1 vocabulary ability correlated to L2 vocabulary acquisition, so much so that L1 expressive vocabulary ability was the most significant variable in FL expressive lexical acquisition among children with DS. It should be noted, however, that even those children with low L1 vocabulary were able to acquire L2 vocabulary in the FL context, suggesting that a low L1 vocabulary does not preclude a child with DS from acquiring L2 vocabulary in the FL context.[27]

Three variables explored which were found to bear no significant relationship to FL vocabulary acquisition warrant discussion considering their importance in the literature: CA, NVC, and outside exposure to the L2. In TD L2 learners, later age of onset has quite consistently resulted in an advantage in L2 acquisition.[28] This advantage is also

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Multilingual Perspectives on Child Language Disorders, ed. Janet L. Patterson and Barbara L. Rodriguez (Bristol, UK: Channel View, 2015), 53.

[26] For no relationship between L1 and L2 in early stages of L2 acquisition in TD individuals and individuals with DLD, see Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14. Blom and Paradis found 15 months of exposure were needed to activate transfer effect from the L1 to the L2. However, this was for verbal inflection, not vocabulary acquisition. Blom and Paradis, "Sources of Individual Differences," 971.

[27] It is important to note that the data gathered in this study only points to correlations, and causality and directionality should be examined in later studies.

[28] He Sun et al., "Individual Differences in Very Young Children's English Acquisition in China: Internal and External Factors," *Bilingualism: Language and Cognition* 19, no. 3 (2016): 561; Vasiliki Chondrogianni and Theodoros Marinis, "Differential Effects of Internal and External Factors on the Development of Vocabulary, Tense Morphology and Morpho-Syntax in Successive Bilingual Children," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 337; María del Pilar García Mayo, "Age, Length of Exposure and Grammaticality Judgements in the Acquisition of English as a Foreign Language," in *Age and the Acquisition of English*, ed. María del Pilar García Mayo and María Luisa García Lecumberri (Bristol, UK: Multilingual Matters, 2003), 94–114; Jasone Cenoz, "The Influence of Age on the Acquisition of English: General Proficiency, Attitudes and Code-Mixing," in García Mayo and García Lecumberri, *Age and the Acquisition of English as a Foreign Language*, 89.

present in L2 learners with DLD.[29] Among bilingual children with DS, CA has been found to correlate with L2 expressive and receptive abilities.[30] However, Trudeau and colleagues found that CA only correlated to the dominant language in bilingual children with DS, which could help explain why no effect was found for CA in the L2 in this study.[31] Despite the evidence from the literature of a possible positive effect of older age of onset for L2 acquisition, older learners in this study showed no significant advantage over younger learners. This divergence may simply be due to the short nature of the study, as the age advantage could take more time to manifest itself.[32] Additionally, many posit that one main reason for an advantage of older age of onset is cognitive maturity.[33] This may be the reason why CA failed to be a factor in FL vocabulary acquisition in the present study, since the cognitive maturity of older learners, though generally higher than the younger learners, was still quite low.

Similarly, NVC did not prove to be a significant factor in FL vocabulary acquisition of participants in this study. Like CA, NVC did not correlate to any measurement of FL vocabulary acquisition. The highest performer on all four measurements of Spanish vocabulary was neither the oldest chronologically nor had the

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29 Tribushinina, Dubinkina-Elgart, and Rabkina, “Can Children with DLD Acquire a Second Language,” 14.

30 Kay-Raining Bird et al., “The Language Abilities of Bilingual Children,” 194–96; Ward and Sanoudaki, “Language Profiles,” 9–12.

31 Trudeau et al., “Développement lexical chez les enfants,” 391.

32 Nils Jaekel et al., “From Early Starters to Late Finishers? A Longitudinal Study of Early Foreign Language Learning in School,” *Language Learning* 67, no. 3 (2017): 645–47. However, while Jaekel and colleagues found that the age effect did not show until later stages of L2 acquisition, Muñoz argues from the literature that older learners have an “initial rate advantage.” Carmen Muñoz, “Symmetries and Asymmetries of Age Effects in Naturalistic and Instructed L2 Learning,” *Applied Linguistics* 29, no. 4 (2008): 579.

33 Chondrogianni and Marinis, “Differential Effects of Internal and External Factors,” 337; Sun et al., “Individual Differences,” 561; Paradis, “Individual Differences in Child English Second Language Acquisition,” 229–30; Blom and Paradis, “Sources of Individual Differences,” 270–71.

highest NVC. This differs from the results found by Kay-Raining Bird and colleagues in which the participant with the highest MA outperformed the other participants on all language measurements and those found by Feltmate and Kay-Raining Bird in which the child with the highest MA and CA scored the highest of all bilingual participants with DS on all language measurements.[34] As with CA, Trudeau and colleagues found that NVC significantly correlated to expressive abilities in the dominant language, but not in the L2. While NVC seems to be an important factor in language acquisition in bilingual children with DS, the case does not seem quite as straightforward in L2 development in the FL context.[35] As Ward and Sanoudaki conclude, NVC may play a lesser role in language development in (L2 learners) with DS than in TD children.[36] Additionally, many participants in this study scored quite low on the measure used for NVC (KBIT-2). A different or more sensitive measure of NVC may reveal different results. Further research is needed support or challenge the findings from this study regarding the role of NVC and CA in FL vocabulary acquisition in children with DS.

Finally, outside exposure to the L2 had no significant correlation to FL vocabulary acquisition despite its importance in L2 development in TD children.[37] Though no data is available for the importance of outside exposure to a FL in children with DS, the overall amount and frequency of input to the L2 is very important in the L2

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[34] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196; Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 18–19.

[35] For more evidence of a correlation between NVC and language development in bilingual children with DS, see Ward and Sanoudaki, "Language Profiles," 9–12.

[36] Ward and Sanoudaki, "Language Profiles," 10.

[37] Sun et al., "Individual Differences," 560; Eva Lindgren and Carmen Muñoz, "The Influence of Exposure, Parents, and Linguistic Distance on Young European Learners' Foreign Language Comprehension," *International Journal of Multilingualism* 10, no. 1 (2013): 120–21; Carmen Muñoz, "Contrasting Effects of Starting Age and Input on the Oral Performance of Foreign Language Learners," *Applied Linguistics* 35, no. 4 (2014): 14–15.

development of bilingual children with DS.[38] In the FL context, one such avenue for input and meaningful exposure to the language could be exposure outside of the classroom. Even though some students were ranked as having received “high” outside exposure to Spanish in this study as measured by a post-intervention parental survey, “high” is relative only to the other students in the study and it should not be considered that they were receiving significant amounts of meaningful exposure to the language outside of class. A typical student who received a rating of “high” outside exposure to Spanish may have read a storybook from class at home multiple times a week, watched, listened, or interacted with some other resource in Spanish (such as a video, game, book, or music) a few times a week, and possibly had someone engage with them in simple conversation in Spanish a few times a week. It stands to reason then that outside exposure did not correlate to FL vocabulary acquisition due to the negligible amount of outside exposure among participants, even those ranked as “high” exposure.

Research Question 5

Research question 5 examined the change in L1 vocabulary levels of children with DS after participation in a six-week FL Spanish class. Given the measurements used, there is no evidence that the L1 abilities of the intervention participants changed over the course of the intervention. Two different types of comparisons were made analyze the change between pre- and post-intervention English vocabulary tests. Neither the *t*-tests nor the GSV difference showed any significant difference in pre- and post-intervention English vocabulary scores among participants with DS only, whether receptive or expressive. Thus, there is no clear evidence that exposure to a FL in a six-week FL class had any impact, positive or negative, on the L1 vocabulary development of

[38] Trudeau et al., “Développement lexical chez les enfants,” 399; Kay-Raining Bird et al., “The Language Abilities of Bilingual Children,” 196; Ward and Sanoudaki, “Language Profiles,” 12; Kay-Raining Bird, “Bilingualism and Children with Down Syndrome,” in Patterson and Rodriguez, *Multilingual Perspectives*, 60.

the intervention participants.

It should be noted that the GSV difference of some students reached statistical significance, both positively and negatively for both the EVT-2 and the PPVT-4.[39] Specific results for each participant can be viewed on table A5 in appendix 18. A wide range of results was present among both participants with DS only and among participants with a dual diagnosis. Accordingly, viewing the GSV results of each individual student presents mixed results, and it is difficult from the raw data to draw any clear conclusions. However, when viewed as a group, no significant change occurred among participants with DS only. The wide individual variation in L1 pre- and post-test results may be due in part to using different forms of the PPVT-4 and EVT-2.[40] It may be cautiously concluded that exposure to a FL had no meaningful impact on the L1 vocabulary development of children with DS. Given that six weeks is a short amount of time for exposure to a FL and for growth in the L1 more long-term studies are needed.

It seems reasonable that exposure to a FL language would not affect L1 vocabulary development in children with DS given the evidence from L1 development in bilingual children with DS. Studies of bilingual children with DS have consistently shown that bilingualism has no detrimental effect on L1 development in bilingual children with DS.[41] Additionally, Edgin and colleagues found that exposure to an L2 has

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[39] The EVT-2 and PPVT-4 manuals each supply a chart which lists statistically significant difference sizes by age group ($p<.10$), and state that "a statistically significant difference is one that is large enough to be unlikely to have occurred by chance (i.e., because of measurement error) . . . (though) statistically significant differences are not necessary for demonstrating growth in vocabulary." Kathleen T. Williams, *The Expressive Vocabulary Test Manual*, 2nd ed. (Minneapolis: NCS Pearson, 2007), 221 and Lloyd M. Dunn and Douglass M. Dunn, *Peabody Picture Vocabulary Test Manual*, 4th ed. (Minneapolis: NCS Pearson, 2007), 205.

[40] The EVT-2 has a mean alternate-form of .87 and the PPVT-4 of .89. Williams, *The Expressive Vocabulary Test Manual*, 66; Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 54.

[41] Katsarou and Andreou, "Bilingualism in Down Syndrome," 4; Ward and Sanoudaki, "Language Profiles," 10; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196–97; Trudeau et al., "Développement lexical chez les enfants," 400; Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 18–19.

no negative impact on cognitive functions in bilingual children with DS.[42] These studies, along with the evidence gathered from this study, should give pause to those professionals who may advise parents against exposing their child with DS to a second language.[43] It seems from the available evidence that children with DS can be exposed to a second language without impeding the development of their first.

Obstacles to Conducting the Research

This research is the first of its kind to document the L2 abilities of children with DS participating in the FL classroom. Though there are many reasons why such research may not have been previously conducted, a large contributing factor is likely the fact that children with DS are not included in the FL classroom at the same rate as their TD peers.[44] Due to the scarcity of their participation, such data would be difficult to gather. Conversely, children with DS are likely excluded from the FL classroom due to the lack of research demonstrating their abilities in the FL classroom, and for lack of examples for FL teachers on how to effectively teach and include children with DS in the FL classroom.[45] Such a dilemma is a catch-twenty-two for researchers, teachers, and

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[42] Jamie O. Edgin et al., "Neuropsychological Effects of Second Language Exposure in Down Syndrome," *JIDR* 55, no. 3 (2011): 351–56.

[43] Fred Genesee, "French Immersion and At-Risk Students: A Review of Research Evidence," *Canadian Modern Language Review* 63, no. 5 (2007): 656; Elizabeth Kay-Raining Bird et al., "The Language Abilities of Bilingual Children with Down Syndrome," *AJSLP* 14, no. 3 (2005): 197; Elizabeth Kay-Raining Bird et al., "Access and Outcomes of Children with Special Education Needs in Early French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 21; Jean Ware, Catrin Bethan Lye, and Fliss Kyffin, "Bilingualism and Students (Learners) with Intellectual Disability: A Review," *Journal of Policy and Practice in Intellectual Disabilities* 12, no. 3 (2015): 226–27.

[44] Stefka H. Marinova-Todd et al., "Professional Practices and Opinions about Services Available to Bilingual Children with Developmental Disabilities: An International Study," *JOCD* 63 (2016): 58; Julia Scherba de Valenzuela et al., "Access to Opportunities for Bilingualism for Individuals with Developmental Disabilities: Key Informant Interviews," *JOCD* 63 (2016): 32–46; Diane Pesco et al., "A Multi-Site Review of Policies Affecting Opportunities for Children with Developmental Disabilities to Become Bilingual," *JOCD* 63 (2016): 15–31.

[45] Elizabeth Kay-Raining Bird, Fred Genesee, and Ludo Verhoeven, "Bilingualism in Children

children with DS. Without children with DS in the FL classroom, research cannot be conducted; without research demonstrating their abilities in the FL classroom, children with DS are not likely to be included.[46]

This research sought to help close this gap, yet faced many obstacles to come to completion, demonstrating the difficulty of carrying out such research. Though all research encounters obstacles, the nature of language acquisition among a special population of children presented unique challenges and intensified the obstacles which may be present in any type of research with human subjects. Obstacles were encountered for intervention location and setting, participant recruitment, participant retention, data collection, and assessment of participants. Each of these obstacles will be discussed below, followed by a summary of notable results of the research obstacles.

Intervention Location and Setting

My original intention was to conduct the research in my Spanish classes at the elementary school where I taught kindergarten through fifth grade Spanish. The school had a program specifically for children with DS. The children were integrated into the classroom and attended Spanish class with their peers. This setting was seemingly ideal, as it reflected the actual parameters of a FL classroom in the elementary school, and the children with DS were integrated into the classroom with their TD peers. The TD peers would serve as the control group, and the intervention would require no extra commitment from any of the participants, as they were already attending Spanish class

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with Developmental Disorders: A Narrative Review," *JOCD*, Article in Press (2016): 11; Johanne Paradis, "An Agenda for Knowledge-Oriented Research on Bilingualism in Children with Developmental Disorders," *JOCD* 63 (2016): 80. Julie Longard and Hélène Deacon, "Bilingualism in Children with Down Syndrome," *Literacy Today* (June 2009): 30.

[46] Kay-Raining Bird and colleagues allude to these challenges in their recommendations for policy, practice, and future research for bilingualism among children with developmental disorders. Elizabeth Kay-Raining Bird, Fred Genesee, and Ludo Verhoeven, "Bilingualism in Children with Developmental Disorders," 11–12.

once a week as part of their school curriculum. However, before I was able to begin collecting data the school closed its doors. While the program for students with DS was moved to another campus, the integration of the students into a larger student body presented too many confounding factors to provide reliable data.

Through contacts from the school, I was able to connect with Down Syndrome of Louisville and proposed to them the idea of offering after school Spanish classes for an entire school year to their elementary-aged clients. This idea was received enthusiastically, and we agreed together to move ahead with the classes once I was allowed to conduct research, and at the start of a new school year. The classes were intended to be divided by grade level and include both children with DS and TD students. My contacts at DSL agreed to help recruit students with DS as well as provide incentives for families to enroll their child in the class, and I would take full responsibility for recruiting TD children.

Approximately three and a half months before the after-school classes were set to begin I met via Zoom with my two contacts at DSL to discuss recruitment of participants. During this conversation I was informed that my plan to offer after school Spanish classes for an entire school year was not likely to succeed. They informed me that they had struggled with retention of participants in enrichment programs previously offered to their clients, and even that if I began the school year with a large number of participants with DS, it was highly unlikely that many, if any, would complete the entire school year of Spanish classes. Families of individuals with DS have many extra commitments such as therapies and doctor’s appointments that most families with TD children do not have, making an extra long-term commitment for families of children with DS extremely difficult. It was very likely that I would end up without participants and thus without data.

They informed me of a six-week educational enrichment camp for elementary-aged children with DS at DSL that summer and invited me to teach Spanish in conjunction with the camp. I agreed on the condition that they would allow me to teach Spanish every day, since students would need ample hours of exposure to the language to demonstrate any amount of measurable acquisition. As a result, Spanish became part of the curriculum of their six-week camp, and all camp participants attended Spanish class. The summer camp was set to begin in less than six weeks from the time of our conversation, during which time ethics committee approval had to be gained, a revised research plan written, approved, and implemented, participants recruited and assessed, and preparation for teaching and classes finalized.

Participant Recruitment

Less than six weeks is not much time to recruit participants and administer pre-intervention assessments. The original plan was to recruit TD children to attend the daily Spanish classes and serve as a control group. Additionally, though all participants at the camp were to attend Spanish class, it was still necessary to recruit students for the study, as specific parental consent had to be granted for students to participate in the research. Finally, children with DS for the L1 vocabulary control group and pilot vocabulary test needed to be recruited. Recruiting children with DS and TD children both posed their own specific challenges and resulted in divergent outcomes.

Intervention participants with DS were recruited through help with my contacts at DSL. Multiple emails and Google Forms, along with a short informative video, were sent to inform families of the opportunity for their child with DS to participate in Spanish class and a research study. However, very little response was received from the emails and Google forms. Later some parents expressed that they receive so many emails, especially from DSL, that they typically ignore them. Most participants were secured through phone calls made by me from DSL. After a personal conversation with me, most parents of those children already attending Spanish as a result of their participation in summer camp were willing to allow their child to participate in the study. A great number of parents expressed over the phone that they had seen the email but were too busy to respond and appreciated the personal phone call. The phone call also gave parents the opportunity to ask questions and overcome any hesitations they may have had about their child participating in the study. Communication with parents via email proved to be challenging throughout the duration of the study and balancing effective communication while respecting professional boundaries often hindered the progress of the study.

Though many parents of children participating in the summer camp agreed to allow their child with DS to participate in the study, this was not the case for all parents. Though not all parents gave a specific reason, the main hesitation that parents expressed for the participation of their child in the study was their hesitancy for their child to be assessed. Some parents were concerned about the ability of their child to sit through the assessments, others did not want to subject their child to more testing than necessary, and still others expressed that they always decline any type of cognitive testing for their child. Conversely, some parents who were willing for their child to participate in the study were unable to do so because their child was not attending the full six weeks of the camp, thus disqualifying them for participation in the study.

Every possible attempt was made to recruit TD students to participate in the Spanish classes to serve as a control group and to create an integrated environment for FL learning. Multiple Facebook posts were made on my personal Facebook page as well as on community pages such as homeschool groups and women's groups which reach many families with children. Emails were sent to various contacts in the community and various attempts were made to connect with people from the local public school system, but with no success. In the end, no TD children were recruited for the Spanish intervention. Aside from the limited amount of time for participant recruitment, the main barrier to the participation of TD children in the classes was the time commitment: students would have to commit to a 45-minute class, five days a week for six weeks during the Summer. This would entail not only a commitment on the part of the child, but on the part of the parent to bring them and pick them up every day. While the students with DS were already committed to being at camp for the entirety of the day, families of TD children could not commit to bringing their child every day for only forty-five minutes. By the time I was able to begin recruiting for the study, many families had summer travel plans, and others simply could not commit to bring their child to a certain place for forty-five minutes five days a week for six weeks.

An additional recruitment challenge was that of finding participants for the English vocabulary control group. Many of my personal contacts of children with DS did not qualify for participation in the L1 control group due to their prior or current participation in the FL classroom. The only other option was to recruit students through DSL. However, many of DSL's elementary-aged clients who would typically agree to participate in a study were participating in the summer camp, and thus not eligible to participate in the L1 control group. Additionally, due to the short time frame between the decision to hold the Spanish intervention class at the camp and the start of the camp, priority was given to recruiting students for the intervention group. My contacts at DSL needed to hand pick who I could contact for the L1 control group and provide me with their contact information but were busy with the details of preparing for the camp. Finally, as with the Spanish intervention group, communication with parents was also a challenge in recruiting students for the English vocabulary control group. All of these confounding factors resulted in a very small L1 control group of only three participants.

Participant Retention

Acquisition of a FL requires a considerable amount of exposure to the language, and thus FL acquisition research cannot be conducted in a short time span. With the increase of time comes an increased risk of participant withdrawal. Anyone considering conducting research in FL acquisition must consider the possibility that they may not retain all of their participants, with this risk increasing as the duration of the study increases. Two students who originally agreed to participate in the study withdrew from the camp after only a few days, and thus were removed from the intervention group.[47] While two participants may seem like a small number, it resulted in a 13 percent decrease in the number of participants. Moreover, concerns of participant retention were the driving force behind abandoning the plan for after-school Spanish classes. Were it not for the opportunity to teach at the six-week summer camp, the problem of student retention likely would have prevented this research from taking place.

Data Collection

Both quantitative and qualitative data were collected for this study. Challenges to the collection of quantitative data will be discussed below under "Assessment of Participants." Qualitative data for the case studies was collected via recording of the Spanish classes, post-class observation notes by me, daily journal entries by assistants, mid-intervention surveys by the assistants, post-intervention assistant surveys and interviews, and post-intervention parental surveys. The collection of qualitative data faced one particular challenge: that of recording the Spanish classes. Recordings were made with an iPhone and an iPad. While the majority of the classes were recorded, the first couple of days were not recorded due to missing parental permission from a few class participants (not study participants). Additionally, during the first few days of class all the energy of myself and the assistants was directed toward make sure that the class went smoothly, and sufficient attention could not be given to students while also setting up and monitoring the recording. Moreover, transition time between classes was short, and setting up the device and ensuring that "record" was pressed properly at the start of

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[47] Parents of both children agreed for their student to continue participation in the study by participating in the English vocabulary control group. As they were exposed to a negligible among of Spanish in their couple of days of participation in the intervention group, they qualified to participate in the English vocabulary control group. However, one of these children has a dual diagnosis of autism and thus did not qualify to participate in the L1 control group.

class sometimes proved to be a challenge. Once class began, the focus of the assistants and myself was on the students, and there were a few times that though the device was set up, the record button was not properly pressed.

Another difficulty was finding an appropriate place to place the iPhone or iPad that could effectively record the case study participants and be conspicuous enough to not distract students. This challenge was particularly acute in the classroom with the youngest students. Having an iPhone or iPad set up for recording in the youngest class could pose a potential safety risk for students or teachers, as well as for the device itself, as many students in the room would swipe or grab and throw any device they could get their hands on. After the first week a place was found where the iPhone could be placed and record the majority of the students in the class. However, students in the younger class often moved around, and placing the device in such a way as to capture all the activity in the classroom proved to be very difficult. Additionally, some days Spanish class for the younger class took place outside on the playground. On such days, aside from a few brief recordings of particular activities, no recording was made and observations were recorded post-class in the journal, on my phone, and on my computer. Despite the challenges of recording every class, more than sufficient data was collected via recordings, observations, surveys, and interviews to accurately describe the participation of the selected students in the intervention classes and to answer the corresponding research questions.

Assessment of Participants

Assessment of participants faced two main obstacles: limited attention span of participants and scheduling of assessments. While these two factors may seem unrelated, they are in fact intricately tied together. Individuals with DS generally have a “significant deficit" in their attention span when compared to their TD peers.[48] As a result of this limited attention span, children with DS may have a difficult time "staying engaged with a task."[49] This difficulty was clearly demonstrated by the difficulty participants experienced in focusing on the assessments. Though breaks were taken between assessments, toward the end of the assessment session, many children could hardly concentrate or give their attention to the assessment. By the final assessment, some children would choose a picture before I had said the word or point to a picture without looking at the other options.

Due to the short attention span of the participants, two separate assessment sessions, especially for the post-intervention assessment, would have been ideal. The post-intervention assessment consisted of six assessments, beyond the capacity of most participants to fully concentrate. However, the difficulty of scheduling assessments made the completion of two separate sessions nearly impossible for the majority of families. All post-intervention assessment sessions needed to be completed within two weeks of the end of the intervention. However, school started only a week and a half after the intervention ended, further shortening the available time frame for scheduling post-intervention assessments. Furthermore, families were busy with the details of preparing for a new school year and as a result their schedules were extra busy. Most families struggled to make the time to schedule one assessment session and requiring students to participate in two post-intervention assessments may have resulted in participant withdrawal or incomplete data. As a result, students were required to complete all six

[48] Susana de Sola et al., "A New Cognitive Evaluation Battery for Down Syndrome and its Relevance for Clinical Trials," *Frontiers in Psychology* 6 (2015): 5. See also Tuomo Määttä et al., "Mental Health, Behaviour and Intellectual Abilities of People with Down Syndrome," *DSRP* 11, no. 1 (2006): 41; Floriana Costanzo et al., "Executive Functions in Intellectual Disabilities: A Comparison between Williams Syndrome and Down Syndrome," *RDD* 34, no. 5 (20S3): 1773; Janice H. Brown et al., "Spatial Representation and Attention in Toddlers with Williams syndrome and Down Syndrome," *Neuropsychologia* 41, no. 8 (2003): 1044.

[49] Grieco et al., "Down Syndrome," 137.

post-intervention assessments in one session.[50]

Results of Research Obstacles

The research obstacles encountered, though many and formidable, did not prevent the research from being carried out successfully. However, the results of these obstacles should be noted as the obstacles impacted the research in various ways.

Sample size. Due to the difficulty recruiting and retaining students for the intervention, the result is a relatively small sample size. Though twenty-seven students participated in the Spanish classes for some length of time, only thirteen students who qualified and were also granted parental permission to participate remained as part of the intervention group until the end of the study. The recruitment for the L1 control group resulted in an even smaller group of four participants. Though the intervention sample and control group were small, care was taken in all statistical analysis to account for small group size. However, it should be recognized that insufficient power may have affected the results of the correlations for research question 4.

Unviability of L1 control group data. My original intention was to compare the change in L1 vocabulary from pre- to post-test in the intervention participants with a control group of children with DS that had not participated in the intervention. Due to the various difficulties in recruiting L1 control group participants, the final control group consisted of 3 children. Due to this small number, the control group was not large enough to provide reliable data and was therefore not used in the final analysis for research question 5.

[50] Two children had particular difficulty concentrating, and it was not possible to complete all six assessments in one session. The parents of these children were agreeable to meeting again. One child completed the remaining assessments in one session, while the other child needed two additional sessions to complete the assessments. Even with the additional sessions, the child struggled to concentrate and complete the assessments. Though other students would have benefited from the same, scheduling and time constraints made that impossible to offer to every student.

No TD participants. One of the most salient effects of recruitment difficulties is the absence of TD participants in the intervention. As a result, there was no TD control group with which to compare the L2 acquisition of the students with DS. Two of the original research questions investigating the L2 acquisition of children with DS were dependent upon TD participants in the Spanish intervention. The research questions were: "Do the post-test receptive lexical abilities of children with Down syndrome differ from that of their typically developing peers following the same amount of Spanish language instruction?" and "Do the post-test expressive lexical abilities of children with Down syndrome differ from that of their typically developing peers following the same amount of Spanish language instruction?"

Due to a lack of a TD control group, these research questions were removed from the study. Likewise, an initial sub-question of research question 1, documenting the participation of children with DS in the integrated FL classroom, was removed: "How do the children with Down syndrome interact with their typically developing peers in the foreign language classroom?"

In addition to serving as a control group, the participation of TD children would have allowed the children with DS to have the experience of learning a FL in an integrated class, possibly increasing their L2 vocabulary acquisition. Sue Buckley and colleagues found that teenagers with DS integrated into the mainstream classroom have higher expressive language scores than those teenagers in the segregated context.[51] While there is no data for the FL context, it is possible that the same would be true of learning an L2 in the FL context. In an integrated class TD students can serve as a model for

[51] Sue Buckley et al., "A Comparison of Mainstream and Special Education for Teenagers with Down Syndrome: Implications for Parents and Teachers," *DSRP* 9, no. 3 (2006): 56–58. Harold Kleinert and colleagues also found that children with severe cognitive disabilities placed in an integrated classroom have higher expressive abilities than those that are educated in the segregated context. Harold Kleinert et al., "Where Students with the Most Significant Cognitive Disabilities are Taught: Implications for General Curriculum Access," *Exceptional Children* 81, no. 3 (2015): 321–22.

children with DS or other disabilities for how to properly participate in class. In the context of a FL class, the response of TD students to L2 input can serve as a sort of scaffolding for children with DS or encourage them to participate in an activity in which they may otherwise choose to not participate. For example, TPR was used on a limited basis in one intervention class. However, the students seemed resistant to participating, so after a few times, I ceased using TPR. In the integrated classroom, elementary-aged TD students are generally very eager to participate in TPR, and thus the children with DS are too. Had TD students been present in the class, TPR may have been a successful method for teaching language.[52] It is possible that the scaffolding and participation of TD students could have bolstered understanding for the participants with DS and facilitated the implementation of a variety of input-rich strategies, thus increasing participant L2 acquisition.

Without the presence of TD students in the class, the assistants often had to serve as the model for students. For example, when instructions were given in Spanish and the students did not understand, the assistants would model the proper response and the students were then able to understand the instructions and respond properly.[53] At times, when students were going to participate in an activity which may be a bit complex for them, such as acting out a story, the assistants would complete the activity first, as an example for the students. In an integrated context, this role would be fulfilled by the TD students.

[52] These observations are based on my own experience, having previously taught Spanish to children with DS in the integrated classroom. A clear difference was seen in students' response to instructions and participation in certain activities in the integrated context and the segregated context, with participation and compliance often higher in the integrated context, especially for those activities, such as TPR, which may require sustained attention.

[53] Students especially needed the additional scaffolding of the example of the assistants in the beginning of the intervention when they had not yet acquired any language. After a couple of weeks, the students understood basic instructions and learned the routine of the class, and the modeling of the assistants for following instructions was less needed. However, assistant support was often needed to help ensure student compliance, as opposed to ensure understanding.

Additionally, Buckley and colleagues found that teenagers with DS have better behavioral outcomes in the integrated context.[54] One of the most prominent barriers to learning and participation in the intervention classes was behavior – either the student's own behavior or the disruptive behavior of another student in the class. It is possible that with the presence of TD students modeling expected behavior, disruptive behaviors may have been reduced, thus increasing the learning of all students.

Finally, the inclusion of TD students in the Spanish intervention would have allowed this study to and serve as an example for FL teachers for how to teach children with DS in an integrated classroom. One of the original purposes of this study was to model for teachers how to effectively include children with DS in the integrated FL classroom. While much valuable data can still be gleaned from this study to be implemented in the integrated FL context, this study cannot serve as a model due to the lack of TD participants.

Reduced results on assessments. The difficulties of students to maintain attention during the post-intervention assessment session likely contributed to reduced results on the L2 assessments. Various studies suggest that attention deficits can negatively affect performance on standardized assessments.[55] While this would suggest

[54] Buckley et al., "A Comparison of Mainstream and Special Education," 58–60. In a study conducted by Joy and Murphy on the inclusion of sixth grade students with special educational needs (including at least one child with DS) in an intensive five-month French as a second language program, students with special educational needs experienced improved behavioral outcomes as a result of the program. Rhonda Joy and Elizabeth Murphy, "The Inclusion of Children with Special Educational Needs in an Intensive French as a Second-Language Program: From Theory to Practice," *Canadian Journal of Education* 35, no. 1 (2012): 112.

[55] Michael I. Posner and Mary K. Rothbart, "Influencing Brain Networks: Implications for Education," *Trends in Cognitive Sciences* 9, no. 3 (2005): 101–2; G. G. Faught et al., "Sustained Attention to Response Task Performance Trajectories in Down Syndrome," *JIDR* 65, no. 3 (2021): 230. While their research was performed on individuals with cognitive disabilities due to being born preterm, Mahurin-Smith and colleagues found that low attention skills contribute to poor performance on standardized tests of intelligence and language in school-aged children born preterm, "accounting for 15%–20% of the variance in children's scores." Jamie Mahurin-Smith, Laura S. DeThorne, and Stephen A. Petrill, "Longitudinal

that the performance of the children of DS was negatively affected for all assessments administered, their performance on the Spanish language assessments, especially the content-based assessments, may have been considerably impacted. To consider the impact of attention difficulties to participant performance on an assessment, consideration should be given to when the assessment was given and how long the children were required to sustain their attention. Faught suggests that difficulties in sustained attention for individuals with DS in the auditory modality could magnify after 7.5 minutes.[56] This effect was observed when assessing the students. As the assessment session progressed, students had a harder time focusing. Their difficulty focusing often exponentially increased the amount of time required to complete an assessment, in turn decreasing focus even further. Thus, the longer sustained attention is required, the lower an individual's performance on a test.

The negative effect of reduced attention on assessment performance may be especially salient when assessing those skills which are predicted by sustained attention, including vocabulary.[57] Particularly vulnerable to the effects of reduced attention are prolonged assessments involving the auditory modality.[58] The assessments measuring receptive vocabulary, while presenting visual stimuli, also depended upon attention to auditory information, and were thus exceptionally vulnerable to the negative effects of reduced attention. In the post-intervention assessment session, the Spanish assessments were administered after the English assessments. Furthermore, the content-based Spanish

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Associations across Prematurity, Attention, and Language in School-Age Children," *JSLHR* 60, no. 12 (2017): 3605.

[56] Faught et al., "Sustained Attention," 234.

[57] Faught et al., "Sustained Attention," 234.

[58] Faught and colleagues state, "difficulty maintaining attention over time in the auditory modality could contribute to poor performance on auditory measures that are prolonged." Faught et al., "Sustained Attention," 234.

assessments were administered at the very end of the session, making them the most susceptible to the effects of reduced attention. Given these factors, it is likely that participant performance on Spanish language assessments, particularly the content-based assessments, did not reflect the full extent of participant L2 acquisition.

Variety of participants with DS. While some of the results of the research obstacles may seem to have negatively affected research outcomes, many positive outcomes resulted as well. The final makeup of the Spanish classes at the summer camp included children with DS with a wide variety of cognitive and linguistic abilities. Several nonverbal children, children with a dual diagnosis of autism, and a child with selective mutism were included in the Spanish classes. Twenty-three percent of the intervention participants had a comorbid diagnosis of ASD, reflective of the prevalence in the DS population.[59] While it cannot be claimed that children representative of all individuals with DS were included in the classes, the research sample likely represents a larger portion of the population of children with DS than would have been represented had the study taken place in a regular integrated classroom or in after-school classes.

At the conclusion of the study, some parents, particularly those of children with multiple diagnoses, expressed their initial doubts about their child's ability to learn Spanish and participate in the study. Had the study taken place in after-school Spanish classes, they very likely would not have signed up their child for the class. However, since the Spanish classes were part of the summer camp curriculum, all students, no matter their cognitive or linguistic abilities, participated in the class. Thus, as a result of the obstacle of intervention location and setting, a wider variety of children with DS were

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[59] Judy Seesahai et al., "Prevalence of Autism Spectrum Disorder (ASD) in all Individuals Diagnosed with Down Syndrome (DS): A Systematic Review and Meta-analysis Protocol," *Journal of Clinical and Medical Research* 4, no. 4 (2022): 5.

able to participate in the classes.

Peer learning. The absence of TD children in the Spanish intervention resulted in various positive outcomes for the children with DS. First, the summer camp was only for students with DS, and it afforded them the opportunity to learn in an environment tailored to them and their specific needs. Spending the day in a classroom full of TD students, in which the child with DS generally lags behind their peers both academically and developmentally, can require a lot of extra effort on the part of the child with DS. It may also be discouraging for children with DS whey they recognize that they are not on the same level as their peers and must put forth extra effort to be included both academically and socially.[60] While students with DS often struggle in the integrated context to be included socially, at the summer camp children were no longer the "special" student in the class, but among their peers with DS.[61] Spanish class offered a unique opportunity for social engagement and learning at the camp. As opposed to other learning contexts at the summer camp in which students were engaged individually or in small

[60] Cuckle reports the frustration and humiliation that children with DS and their parents may feel when they are consistently falling behind their peers academically and may even lose friends due to being held back while their classmates advance. He also notes that social inclusion for children with DS takes much more effort than for TD children. Pat Cuckle, "Getting in and Staying There: Children with Down Syndrome in Mainstream Schools," *DSRP* 6, no. 2 (1999): 97–99. Wendelborg and Kvello documented the perceived social acceptance and peer intimacy of children with disabilities and found that isolation increased with the severity of the disability. Christian Wendelborg and Øyvind Kvello, "Perceived Social Acceptance and Peer Intimacy among Children with Disabilities in Regular Schools in Norway," *Journal of Applied Research in Intellectual Disabilities* 23, no. 2 (March 2010): 149. It is important to note that this documentation was that of the perception of the child, indicating that children with disabilities do indeed perceive that they are isolated from their peers.

[61] Various studies document the difficulties of children with DS and other disabilities to be truly socially integrated in the mainstream classroom. Anne-Stine Dolva et al., "Facilitating Peer Interaction–Support to Children with Down Syndrome in Mainstream Schools," *European Journal of Special Needs Education* 26, no. 2 (2011): 205; Christian Wendelborg and Jan Tøssebro, "Educational Arrangements and Social Participation with Peers amongst Children with Disabilities in Regular Schools," *International Journal of Inclusive Education* 15, no. 5 (June 2011): 497–512; Christian Wendelborg and Kvello, "Perceived Social Acceptance," 143–53; Christian Wendelborg and Jan Tøssebro, "School Placement and Classroom Participation among Children with Disabilities in Primary School in Norway: A Longitudinal Study," *European Journal of Special Needs Education* 23, no. 4 (2008): 316–17.

groups, Spanish class was an opportunity for all students to be engaged together learning the same thing at the same time.

Though there is evidence to suggest that the presence of TD peers could bolster the L2 acquisition of the children with DS, there is also reason to believe that it may have been to the benefit of the students to learn an L2 in an environment tailored to the needs and interests of children with DS. During the intervention the needs and interests of the students and the rate of their learning dictated the activities in Spanish class and the rate at which we advanced in the curriculum. The presence of TD children may have necessitated at times that we include other activities which may not have been as preferable for the children with DS, or that we advance more quickly through material to hold the interest of the TD students. For example, older children with DS may enjoy a video that same-aged TD peers would find juvenile and thus not appropriate for an integrated classroom.[62] The absence of TD peers facilitated the use of such videos with the older children and were rich and engaging sources of comprehensible input for the students.

Finally, learning exclusively with students with DS allowed the stronger students to be the example in class. In a very real sense, they fulfilled the role of the model in class that would otherwise be fulfilled by TD students. This reaps benefits not only for the child who is serving as the example, but for all the children in the room who see that a child with DS can be the model and set the example. Students were encouraged to applaud for each other and rejoiced when another student experienced success. Thus, though education in the integrated environment has many strengths, this short-term

[62] In their qualitative study of social integration of children with DS in the mainstream classroom Dolva and colleagues found that the interests of children with DS often differed from that of their TD peers and report that children with DS were perceived to be more “immature” than their TD peers. Dolva et al., “Facilitating Peer Interaction,” 205.

segregated learning environment tailored to the needs of children with DS may have benefited student learning and morale.

Daily L2 exposure. Though holding the intervention classes at a six-week summer camp was not the intended setting, it may have served for the benefit of the participants' L2 acquisition. As a result of holding the classes during the six-week summer camp, learners were exposed to the language daily for six weeks.[63] Though the overall hours of exposure were less than if the students had attended class at school or an after-school class, the frequency of exposure was much more often.[64] Frequency is a key factor in L2 acquisition.[65] It is therefore likely that due to daily exposure, students were able to acquire more language than if they had only been exposed to the language once a week over a longer period of time.

Summary of Research Findings

Below is a succinct summary of the findings of this research, divided by research questions.

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[63] Students were exposed to the language five days a week, Monday through Friday for three weeks with a one-week intermission, followed by another consecutive three weeks.

[64] Had the students attended a one hour once-a-week after school class for the duration of the school year, they would have received thirty-five hours of language instruction. Had they attended a forty-five minute once-a-week after school class for the duration of the school year, they would have received 26.25 hours of language instruction. By attending a six-week class which met for forty-five minutes per session, they received 22.5 hours of instruction. A comparison to an in-school class is much more difficult to make, as elementary FL classes vary widely in duration and frequency of instruction. However, if the study had taken place as originally planned in my classroom, one school year of teaching would have resulted in 26.25 hours of language instruction, as classes met once a week for forty-five minutes.

[65] Trudeau et al., "Développement lexical chez les enfants," 399; Elizabeth Kay-Raining Bird, "The Case for Bilingualism in Children with Down Syndrome," in *Language Disorders from a Developmental Perspective*, ed. Rhea Paul (Mahwah, NJ: Lawrence Erlbaum Associates, 2007), 267; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 60; Anne Vermeer, "Breadth and Depth of Vocabulary in Relation to L1/L2 Acquisition and Frequency of Input," *Applied Psycholinguistics* 22, no. 2 (2001): 230.

Participation and Acquisition in the FL Classroom

Students with DS with and without ASD are able to successfully participate in the FL classroom given the proper support. When provided with sufficient scaffolding children with DS can understand the L2 in the FL classroom and based upon observations, students with DS demonstrate some acquisition of the L2 in the FL classroom. Though some students may need behavioral or content support to participate fully in the FL classroom, other students are able to participate fairly independently. Students with DS demonstrate comprehension and non-comprehension of the language in a variety of ways and enjoy a wide variety of engaging and interactive activities in the FL classroom.

L2 Acquisition

Children with DS are able to acquire both receptive and expressive L2 vocabulary in the FL context as measured by quantitative assessments. While the amount of acquisition demonstrated through quantitative assessments varies widely, some children were able to experience a high degree of success and acquire a considerable amount of both receptive and expressive vocabulary. All children who participated in the intervention demonstrated evidence of receptive L2 acquisition. Students demonstrated more acquisition as measured by the curriculum-based assessments than measured by the standardized assessments. Additionally, children with a dual diagnosis of ASD performed on par with their peers with DS only in measurements of receptive and expressive L2 abilities. Like the participants with DS only, all participants with a dual diagnosis demonstrated receptive acquisition, while only one of the three demonstrated expressive acquisition as measured by the assessments.

Expressive vs. Receptive L2 Acquisition

Children with DS demonstrated higher levels of receptive acquisition than expressive. This conforms to the general language profile of monolingual and bilingual individuals with DS. While some children achieved substantial amounts of expressive vocabulary acquisition, all students acquired more receptive than expressive vocabulary.

Variables in L2 Acquisition

Of the variables investigated, the following variables had a statistically significant relationship to FL acquisition: L1 expressive lexical ability, maternal education, performance on a NWRT, and L1 receptive lexical ability. Certain variables which have in other contexts been found to correlate to language acquisition in children with DS or L2 acquisition in TD children did not demonstrate a statistically significant relationship to FL acquisition, namely, CA, NVC, and outside exposure to the L2.

L1 Vocabulary Change

There is no evidence that L1 vocabulary changed during the course of the Spanish intervention. Of the two types of comparisons made no significant change was found between pre- and post-test expressive or receptive vocabulary in intervention participants. Given these results, it seems that six weeks of exposure to a FL did not appear to have any meaningful impact on L1 vocabulary development.

Implications and Recommendations for Practice

Children with DS have traditionally not been afforded the same opportunities as their peers to learn or maintain an L2.[66] One of the reasons children with DS have been excluded from the FL classroom is due to lack of examples of children with DS participating in the FL classroom. As a result, their capabilities in the FL classroom are unknown, and teachers do not have access to examples of how to effectively include

[66] Marinova-Todd et al., "Professional Practices and Opinions," 58; de Valenzuela et. al, "Access to Opportunities," 32–46; Pesco et al., "A Multi-site Review," 15–31.

children with DS in the FL classroom.[67] Additionally, teachers, professionals, and parents have expressed hesitancy as to whether or not children with DS are capable of acquiring an L2 or should be exposed to an L2.[68] This research demonstrates that when given the proper support children with DS with and without a dual diagnosis of ASD can successfully participate in the FL classroom and as a result can acquire both receptive and expressive vocabulary in the FL classroom to varying degrees. This research also provides an example for FL teachers of how to facilitate the participation of and FL acquisition of children with DS in the FL classroom.

Is it thus recommended that administrators and FL teachers seek to include children with DS with or without a dual diagnosis of ASD in the FL classroom and provide for them the needed support for them to experience success. This support should come in the form of an assistant for the child with DS if needed, recognizing that not all children with DS may need an assistant to successfully participate in the FL classroom. Additionally, the teacher should ensure that their teaching practices are suitable for children with DS. It is likely that the scaffolding needed by children with DS will also benefit TD children. Additionally, professionals giving guidance to parents of children with DS should present parents with accurate information regarding the L2 abilities of children with DS and evidence that children with DS with and without ASD can successfully participate in the FL classroom.[69] When presented with the opportunity, parents may consider allowing their child to participate in the FL classroom. While it is

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[67] Kay-Raining Bird, Genesee, and Verhoeven, “Bilingualism in Children with Developmental Disorders,” 11; Julie Longard and Hélène Deacon, “Bilingualism in Children with Down Syndrome,” *Literacy Today* (June 2009): 30.

[68] Paradis, “An Agenda for Knowledge-Oriented Research,” 80; de Valenzuela et. al, “Access to Opportunities,” 38–40; Genesee, “French Immersion and At-Risk Students,” 656; Kay-Raining Bird et al., “The Language Abilities of Bilingual Children,” 197; Kay-Raining Bird et al., “Access and Outcomes,” 21–22; Ware, Lye, and Kyffin, “Bilingualism and Students,” 227–28.

[69] Kay-Raining Bird, Genesee, and Verhoeven, “Bilingualism in Children with Developmental Disorders,” 11.

not guaranteed that every child with DS will acquire an L2 in the FL classroom, it is likely that they may acquire some amount of FL vocabulary when properly supported in class. Not only might the child benefit from learning another language, but they may highly enjoy participation in the FL classroom.

Furthermore, while various factors contribute to successful FL acquisition, no single factor precludes FL acquisition in children with DS. That is, even those children with low cognition and/or low L1 skills were able to demonstrate evidence of FL acquisition to varying degrees. Teachers, practitioners, administrators, and parents should not assume that a child with low cognition or low L1 skills will not be able to acquire at least some L2. Children with DS of varying abilities should be given the opportunity to participate in the FL classroom. With the proper scaffolding, most children can experience some level of success. While each child's case should be considered carefully, the success experienced by the wide variety of students in this study sets a precedent for children of varying abilities to successfully participate in the FL classroom.

Finally, a prevailing concern among parents, teachers, and professionals regarding L2 exposure among children with DS is the possible negative impact that exposure to an L2 may have on the L1 development of children with DS.[70] This study demonstrates that exposure to a FL does not seem to negatively impact L1 vocabulary development in children with DS. Thus, while L1 vocabulary development did not change during the course of the intervention, L2 acquisition occurred. Professionals giving guidance to parents of children with DS should provide parents with this information so that parents can make rightly informed decisions regarding their child's educational path. While parents may have a variety of reasons for not wanting their child to participate in the FL classroom, misinformation, such as the inability of their child to

[70] Marinova-Todd et al., "Professional Practices and Opinions," 48; Rebecca Ward, "Profiling the Language Abilities of Welsh-English Bilingual Children with Down Syndrome" (PhD diss., Bangor University, 2020), 141–42.

learn a FL or possible harm to L1 development as a result of that participation, should not be a reason.

Though this study only examined FL acquisition among children with DS, these results carry implications for children with other learning and intellectual disabilities. Though every disability is unique, DS is a complex combination of impairments. Despite considerable cognitive and linguistic impairment, participants with and without a comorbid diagnosis of ASD were able to experience success participating in a FL class and acquiring FL vocabulary. It is possible that children with other intellectual, learning, or cognitive disabilities may also be able to experience some level of success in the FL classroom. Administrators, teachers, and parents should consider these findings when considering if a child with other learning, language, or cognitive disabilities should participate in the FL classroom. It is likely that with the proper scaffolding and support they too can experience success and have a positive experience in the FL classroom.

A Charge to Christian Schools

A special word is warranted for administrators and teachers in Christian schools. While it is likely that most teachers and administrators in Christian schools would not doubt the worth or value of a child with DS, they may doubt their ability to participate in a FL classroom or successfully acquire a FL. This is evident by the attitude of administrators and teachers in the Christian school in which I worked. Though administrators wanted the children with DS to participate in Spanish class, they expressed their low expectations for them to learn the language. Furthermore, one teacher even said it was “stupid” that we would expect them to learn a second language when they have such a hard time with English. Though likely expressed out of a concern for the children, such attitudes are not reflective of a true desire to integrate children with DS nor a belief in their abilities to learn and achieve.

As believers in the doctrine of *imago Dei* and the resulting uniqueness and dignity of every child, Christian schools should lead the way in educating children with DS and other intellectual disabilities. Not only that, but they should intentionally seek to provide them with the same opportunities afforded to TD peers, such as learning a FL, when such services are provided in their school. This study demonstrates that children with DS with and without a comorbid diagnosis of ASD are capable of successfully participating in the FL classroom and acquiring FL vocabulary and serves as a precedent for Christian schools.

Finally, Christian schools should not only include children with DS and other intellectual disabilities in the FL classroom, but train their teachers, including their FL teachers, to provide the support needed for such children to experience success. It is the duty of the Christian school and teacher to utilize diverse strategies "to match diverse learning outcomes, based on the individual and situation."[71] In his commentary on Titus 2:1–15, scholar of Christian Education James Estep states that the teaching ministry of the church must respond to the needs of the individual and thus "instruction must be tailored to the needs of the specific group or age level . . . (and) take into account the learner and the context in which the instruction will occur."[72] Utilizing teaching strategies which are tailored to the individual, including children with DS, honors the diversity and varying abilities of those whom God has created and entrusted to our care. While not exhaustive, this study provides a starting point for FL teachers seeking to include children with DS in the FL classroom.

Christian teachers and administrators should be advocates and supporters of children with DS in both word and in deed. As such, they must provide children with DS

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[71] James R. Estep, "Biblical Principles for a Theology of Christian Education," in *A Theology for Christian Education*, by James R. Estep, Michael J. Anthony, and Gregg R. Allison (Nashville: B & H Academic, 2008), 55.

[72] Estep, "Biblical Principles," 57.

with opportunity and the needed support, all the while believing that they are truly capable of achieving success. It is our privilege and duty to help children with DS and other disabilities flourish, succeed, and attain the highest fulfillment of their God-given abilities, one of which could be learning a FL.[73]

Further Research

This study is the first to explore FL acquisition of children with DS with and without a dual diagnosis of ASD and their participation in the FL classroom. While the findings of this study are valuable and contribute greatly to the field of second language acquisition in children with DS, further research is needed to more fully understand FL acquisition in children with DS and to facilitate their successful participation in the FL classroom. The following list provides recommendations for future research of FL acquisition in children with DS and the contributions they can make.

1. Studies in which children with DS are exposed to a FL for more substantial lengths of time are needed to understand FL acquisition in children with DS beyond its incipient stages. This would also facilitate the examination of grammatical acquisition of a FL in children with DS since grammatical development is delayed in individuals with DS and likely needs substantial exposure to the language for measurable development to occur.

2. Studies with TD children serving as a control group are needed to understand how FL acquisition in children with DS differs from that of their TD peers.

3. Studies which examine the factors which relate to FL acquisition in DS are needed to build upon the preliminary findings of this study.

4. Longitudinal studies which track the retention of acquired FL vocabulary as compared to a TD control group are needed.

5. Studies among other age groups of individuals with DS such as adolescents and adults could not only help answer the question as to whether these age groups are able to acquire a FL but could add more information as to the age effect among individuals with DS.

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[73] For a similar reflection, see Judy Chesson, “What’s Special about Special Education in Christian Schools?,” *Christian Teachers Journal* 26, no. 1 (2018): 27. See also Philip Stegink, “Disability to Community: A Journey to Create Inclusive Christian Schools,” *Journal of Religion, Disability & Health* 14, no. 4 (2010): 368–81.

6. Studies with larger control groups for L1 development are needed to more accurately assess the impact of exposure to a FL on the L1 development of children with DS. Studies in which children are exposed to a FL for longer amounts of time and greater quantity would also be useful in this regard, as well as pre- and post-test measurements of L1 vocabulary using the same assessment, rather than alternate forms.

7. Studies with languages besides Spanish as a FL are needed to add to our understanding of FL acquisition among children with DS and to determine if linguistic proximity has any bearing on the ability of children with DS to acquire a FL.

8. Studies which further examine the relationship between verbal short-term memory and FL acquisition could explore whether exposure to a FL improves verbal short-term memory in individuals with DS.

9. Studies of children with DS participating in the FL class in the school context would be valuable to better understand their participation and acquisition in the context of the school FL classroom with its unique parameters and constraints.

10. Studies which compare the effectiveness of teaching methodologies and strategies for children with DS could aid teachers in more effectively teaching a FL to children with DS.

11. Studies which compare FL acquisition of children with DS in the integrated context and separated context could add to our understanding of which context is more effective for facilitating FL acquisition in children with DS.

12. More case studies of children with DS with a wide range of cognitive and linguistic abilities, as well as confounding factors such as autism, should be conducted to understand more in depth the abilities of children with DS to acquire a FL and their participation in the FL classroom. Case studies which include interviews with the students themselves could also be valuable to consider their perception of participation in the FL classroom and learning a FL.

13. Studies which incorporate alternative methods of assessments may prove valuable to better capturing the full extent of FL acquisition by children with DS. These methods could include allowing students to act out words rather than merely identifying a picture or incorporating play and assessing language via a checklist or questionnaire.

14. Studies which investigate variables in FL acquisition, not only in terms of correlation, but also in terms of causality and directionality would be valuable.

Conclusion

This is the first study of its kind to document the participation of children with DS in the FL classroom and their L2 acquisition in the FL context. This study clearly demonstrates that children with DS with and without a dual diagnosis of ASD are capable of successfully participating in the FL classroom and acquiring FL vocabulary. All children who participated in the study, with a wide spectrum of cognitive and linguistic abilities, demonstrated evidence of FL acquisition. While all children demonstrated more receptive than expressive acquisition, some children demonstrated a considerable amount of expressive FL vocabulary after only six weeks of instruction. This study also examined the factors which contribute to FL vocabulary acquisition and demonstrates that exposure to a FL does not adversely impact L1 vocabulary development in children with DS. While results from this study need to be confirmed by further studies, this study suggests that children with DS should not be excluded from the FL classroom based on diagnosis, nor cognitive or L1 abilities, and should be afforded the same opportunities as their TD peers to acquire a FL.

APPENDIX 1

AGREEMENT TO PARTICIPATE SPANISH
INTERVENTION AND DATA GATHERING

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a study designed to assess their acquisition of Spanish after having participated in a six-week Spanish class. This research is being conducted by Emily Ibrahim for purposes of her doctoral dissertation research. The research consists of three parts: 1) pre-intervention assessments 2) intervention – 6-weeks of Spanish class 3) post-intervention assessments.

1. *Pre-Intervention Assessments*
In the pre-intervention research, a person will undergo a series of assessments to determine their cognitive abilities and English vocabulary. They will be required to look at a series of pictures and point to the answer which completes the pattern or represents the word they heard, or verbally describe the picture in one word. They will also listen to a series of non-words (non-sense words) and be asked to repeat them. The non-word task will be audio recorded for the purposes of accurate scoring.

2. *Intervention*
In the intervention phase, a person will participate in a 6-week Spanish course held at Down Syndrome of Louisville. The course will meet every day, Monday through Friday, for 45 minutes. The course will take place for two three-week periods, with a week break in-between. The dates of the course are June 13 to July 1 and July 11 through July 29.

All Spanish classes will be recorded for the purposes of research. The recording *will not be made public* and will *only* be viewed by Emily Ibrahim. Indicate whether or not you grant permission for your child to be recorded by signing your initials next to the corresponding choice below.

____ I agree to allow my child to be recorded in the Spanish class.
____ I do not agree to allow my child to be recorded and request that accommodations be made so that my child will not appear in the recording.

3. *Post-Intervention Assessments*
In this post-intervention research, a person will undergo a series of assessments to determine their Spanish vocabulary acquisition and English vocabulary levels. The person will be required to look at a set of pictures and point to the picture which represents the word they heard, or verbally describe the picture in one word.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses. *Participation in this study is totally voluntary, and the person you are giving approval to participate in this study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in this research if he or she desires.

Participant Name ____

Parent/Guardian Name ____

Parent/Guardian Signature ____

Date ___________________

APPENDIX 2

AGREEMENT TO PARTICIPATE CASE STUDY

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a case study designed to describe their participation in a six-week Spanish class and their acquisition of Spanish after having participated in the class. This research is being conducted by Emily Ibrahim for purposes of her dissertation research. In this research, a person will be video recorded as they participate in a Spanish class. The recording *will not be made public* and will only be viewed by Emily Ibrahim for research and documentation purposes. The teacher (Emily Ibrahim) will also record observations of the person's participation in a journal after each class. Assistants in the class may also observe the student in the class and supply their observations through a journal, survey, and interview.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses or description. *Participation in this case study is totally voluntary, and the person you are giving approval to participate in this case study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in this research if he or she desires.

Participant Name ____

Parent/Guardian Name ____

Parent/Guardian Signature _______________________________________

Date __________________

APPENDIX 3

AGREEMENT TO PARTICIPATE
SPANISH INTERVENTION

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a study designed to assess acquisition of Spanish in children with Down syndrome after having participated in a six-week Spanish class. This research is being conducted by Emily Ibrahim for purposes of her doctoral dissertation research.

In the Spanish intervention phase (Spanish class) a person will participate in a 6-week Spanish course held at Down Syndrome of Louisville. The course will meet every day, Monday through Friday, for 45 minutes. The course will take place for two three-week periods, with a week break in-between. The dates of the course are June 13 to July 1 and July 11 through July 29.

All Spanish classes will be recorded for the purposes of research. The recording *will not be made public* and will *only* be viewed by Emily Ibrahim. Indicate whether or not you grant permission for your child to be recorded by signing your initials next to the corresponding choice below.

____ I agree to allow my child to be recorded in the Spanish class.

____ I do not agree to allow my child to be recorded and request that accommodations be made so that my child will not appear in the recording.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses. *Participation in this study is totally voluntary, and the person you are giving approval to participate in this study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in the Spanish intervention (Spanish class) only.

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in this research if he or she desires.

Participant Name ____

Parent/Guardian Name ____________________________________

Parent/Guardian Signature _________________________________

Date ________________

APPENDIX 4

AGREEMENT TO PARTICIPATE
INSTRUMENTATION
PILOT TEST

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a study designed to assess the validity of a vocabulary test. This research is being conducted by Emily Ibrahim for purposes of her doctoral dissertation research. In this research, a person will undergo a series of vocabulary assessments. They will be required to look at a series of pictures and point to picture which represents the word they heard or verbally describe the picture in one word.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses. *Participation in this study is totally voluntary, and the person you are giving approval to participate in this study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in this research if he or she desires.

Participant Name ____

Parent/Guardian Name _______________________________________

Parent/Guardian Signature ____________________________________

Date _________________

APPENDIX 5

AGREEMENT TO PARTICIPATE
L1 CONTROL GROUP

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a study designed to assess their English vocabulary over a period of six-weeks. This research is being conducted by Emily Ibrahim for purposes of her doctoral dissertation research. In the first part of this research, a person will undergo a series of assessments to determine their cognitive abilities and English vocabulary skills. They will be required to look at a series of pictures and point to the answer which completes the pattern or represents the word they heard, or verbally describe the picture in one word. After six weeks, in the second part of this research, a person will undergo a series of assessments to determine their English vocabulary skills. The person will be required to look at a set of pictures and point to the picture which represents the word they heard, or verbally describe the picture in one word.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses. *Participation in this study is totally voluntary, and the person you are giving approval to participate in this study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in this research if he or she desires.

Participant Name ____

Parent/Guardian Name ____

Parent/Guardian Signature _______________________________________

Date __________________

APPENDIX 6

PARTICIPANT BACKGROUND
INFORMATION FORM

General Information

Last Name __________________________ First Name __________________________

Date of birth ______/______/_______ Age _____years _____months Sex _______

Race/Ethnicity ___________________________ Grade Entering (2022-23) __________

Medical History

Has your child received a diagnosis of Down syndrome?

____ Yes, my child has received a diagnosis of Down syndrome.

____ No, my child has not received a diagnosis of Down syndrome.

WHO diagnosed your child with Down syndrome?

____ A medical physician diagnosed my child with Down syndrome.

____ A psychologist diagnosed my child with Down syndrome.

____ Other, please specify: ____

WHERE was your child diagnosed with Down syndrome?

____ In a hospital

____ In a Dr.'s office or medical clinic

____ In a school

____ Other, please specify: ____

With which subtype of Down syndrome was your child diagnosed?

____ Trisomy 21

____ Translocation

____ Mosaic

____ I'm not sure

Has your child received a diagnosis of autism spectrum disorder? _____Yes _____No

Has your child ever experienced a traumatic brain injury? _____Yes _____No

Which best describes your child's hearing status as confirmed by a recent audiogram?

___ Normal hearing ___Normal hearing after correction

___ Mild hearing loss with no correction ___ Mild hearing loss after correction

___ Moderate hearing loss with no correction ___ Moderate hearing loss after correction

___ Severe hearing loss with no correction ___ Severe hearing loss after correction

___ I don't have a recent audiogram but have marked the hearing status I believe to be most accurate.

Comments on hearing status: ____

____

Language Exposure

*Is English your child's first and only language (with exception of sign)?*___Yes ___No

Has your child previously participated in a Spanish class? ____Yes _____No

Has your child had previous significant exposure to the Spanish language? __Yes __No

Has your child ever attended a foreign language class of a language other than Spanish?

____Yes ____No

If so, what language, with what frequency, and for how long? ______________________

____

Comments on language exposure: ____

____

Parental Information

Highest level of father's education:

___High school ___Technical Certificate ___Bachelor ___Masters ___Doctorate

____ other (specify) ______________________

Highest level of mother's education:

___High school ___Technical Certificate ___Bachelor ___Masters ___Doctorate

_____ other (specify) ____________________

Parent/Guardian Name ____

Parent/Guardian Signature ____________________________________

Date __________________

APPENDIX 7

CASE STUDY JOURNAL OBSERVATION QUESTIONS

Date_____ / _____ / _____

Based on your observations of the child in class today, please answer the following questions:

1. Did the child seem especially engaged in a particular activity today? If so, what? How did they demonstrate engagement?

2. Did the child seem especially distracted or disinterested in a particular activity today? If so, which activity? What behaviors did they demonstrate that led you to believe they were distracted or disinterested?

3. Was there any activity today that seemed particularly challenging for the child today? If so, what and why? How did they demonstrate that it was challenging for them?

4. Was there a time in class when the child seemed to really not understand what was happening? When was that and how did they demonstrate that they weren't understanding?

5. Was there a time in class when the child really seemed to understand the Spanish being used in class? How did you notice?

6. Did you hear the child say anything in Spanish today?

7. Did the child need your support today? Is so, what type of support did you offer? Did it appear helpful? How so?

8. What was the child's overall demeanor today in class? Did it change during the duration of the class?

9. Are you aware of anything that happened at home (lack of sleep, changed schedule) or during camp that may have negatively affected the child's engagement or behavior in class today?

APPENDIX 8

MID-INTERVENTION ASSISTANT
SURVEY QUESTIONS

Student Name: ___________________________________

Please answer the following questions <u>*based upon your observations*</u> of and interactions with the child in the Spanish class:

1. On a scale of 0 to 5, with zero being consistently unengaged and 5 being consistently engaged, how would you rate the child's overall engagement in the class?

Unengaged ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Engaged
Comments:

2. On a scale of 0 to 5, with zero being completely negative, and 5 being completely positive, how would you rate the child's overall *attitude* towards Spanish?

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive
Comments:

3. On a scale of 0 to 5, with 0 being completely negative, and 5 being completely positive, how would you rate the child's *experience* in Spanish class?

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive
Comments:

4. On a scale of 0 to 5, with 0 being no comprehension and 5 being complete comprehension, how would you rate the child's general comprehension of the Spanish used in the class?

No comprehension ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Full Comprehension
Comments:

5. On a scale of 0 to 5, with 0 being isolated and 5 being completely integrated, how would you rate the child's integration in the class?

Isolated ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Integrated
Comments:

6. On a scale of 0 to 5, with 0 being dependent on assistance and 5 being completely independent, how much support from you as an assistant did the child need to participate in the class?

Dependent ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Independent
Comments:

7. On a scale of 0 to 5, with 0 being no learning and 5 being considerable learning, how would you rate the child's learning of Spanish?

No learning ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Considerable learning
Comments:

8. Ona a scale of 0 to 5, with 0 being completely unbeneficial and 5 being highly beneficial, how would you rate the overall effectiveness of the activities in class for the child's learning?

Unbeneficial ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Beneficial
Comments:

9. On a scale of 0 to 5, with 0 being dislike and 5 being highly enjoyed, how would you rate the child's overall enjoyment of the activities in class?

Dislike ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Enjoyed
Comments:

APPENDIX 9

POST-INTERVENTION ASSISTANT SURVEY
AND INTERVIEW QUESTIONS

Assistants were given a survey after the end of the course for those children participating in the case study. This survey consisted of the questions numbered one through 10. The follow up questions were asked in the interview with me.

Please answer the following questions *based upon your observations* of and interactions with the child in the Spanish class:

1. On a scale of 0 to 5, with zero being consistently unengaged and 5 being consistently engaged, how would you rate the child's overall engagement in the class?

Unengaged ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Engaged

Follow up question:
What are the behaviors which demonstrated to you the child's engagement or disengagement?

2. On a scale of 0 to 5, with zero being completely negative, and 5 being completely positive, how would you rate the child's overall *attitude* towards Spanish?

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive

Follow up question:
What indicated to you the child's attitude?

3. On a scale of 0 to 5, with 0 being completely negative, and 5 being completely positive, how would you rate the child's *experience* in Spanish class?

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive

Follow up questions:
Why did you rate the child's experience as negative/positive?
What factors did you observe that contributed to this positive/negative experience?

4. On a scale of 0 to 5, with 0 being no comprehension and 5 being complete comprehension, how would you rate the child's general comprehension of the Spanish used in the class?

No comprehension ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Full Comprehension

Follow up questions:
What behaviors signaled to you that the child was not understanding?
What behaviors signaled to you that the child was understanding Spanish?

5. On a scale of 0 to 5, with 0 being isolated and 5 being completely integrated, how would you rate the child's integration in the class?

Isolated ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Integrated

Follow up questions:
What would you identify as the greatest barriers to the child's participation in the class?
What types of things did the teacher to do help facilitate participation of the child in class?

6. On a scale of 0 to 5, with 0 being dependent on assistance and 5 being completely independent, how much support from you as an assistant did the child need to participate in the class?

Dependent ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Independent

Follow up questions:
Did this level of independence evolve throughout the course, or was it fairly consistent?
What kind of support or assistance did the child need from you?
Were there certain activities that the child needed more support from you than others?

7. On a scale of 0 to 5, with 0 being no learning and 5 being considerable learning, how would you rate the child's learning of Spanish?

No learning ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Considerable learning

Follow up question:
What indicated to you the child's learning or lack thereof?

8. On a scale of 0 to 5, with 0 being completely unbeneficial and 5 being highly beneficial, how would you rate the overall effectiveness of the activities in class for the child's learning?

Unbeneficial ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Beneficial

Follow up questions:
Which activities do you think most helped the child learn Spanish?
What activities do you think the child least benefited from in class?

9. On a scale of 0 to 5, with 0 being dislike and 5 being highly enjoyed, how would you rate the child's overall enjoyment of the activities in class?

Dislike ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Enjoyed

Follow up questions:
What do you think were the child's favorite activities?
What do you think the child least enjoyed in class?

Final questions:
Do you have any final observations pertaining to the child's participation in class?

Do you have any final observations regarding the child's acquisition of Spanish?

Based upon your observations of the child in class, if you were to give any advice to foreign language teachers seeking to integrate children with DS into the foreign language classroom, what would it be?

Based upon your experience in the class, if you were to give any advice to assistants in the foreign language classroom, what would it be?

APPENDIX 10

POST-INTERVENTION PARENTAL
CASE STUDY SURVEY

Please answer the following questions *based upon your observations* of and interactions with your child and their experience in Spanish class:

1. On a scale of 0 to 5, with zero being completely negative, and 5 being completely positive, how would you rate the child's overall *attitude* towards the Spanish language? If you did not observe, please choose "not observed."

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive

______ Not observed

What indicated to you your child's attitude?

2. On a scale of 0 to 5, with 0 being dislike and 5 being highly enjoyed, how would you rate your child's overall enjoyment of the Spanish class? If you did not observe, please choose "not observed."

Dislike ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Enjoyed

______ Not observed

What indicated to you your child's enjoyment or lack thereof?

Additional questions:

Has your child showed you any evidence of acquisition of Spanish, such as saying words or recognizing words in Spanish?

Do you have any other observations pertaining to your child's participation in class?

Do you have any other observations regarding your child's acquisition of Spanish?

Outside Exposure

During the duration of the Spanish course:

1. On average, how often did you or someone else in the family read with your child the story books in Spanish provided by Ms. Emily? (This includes listening to the recording)

___never ___a few times ___ once a week ___ multiple times a week

2. On average, how often did your child view videos on Maestra Ibrahim's YouTube channel?

___never ___a few times ___ once a week ___ multiple times a week

3. On average, how often did your child watch, listen to, or interact with other resources in Spanish (such as videos, games, books, music, etc.)?

___never ___a few times ___ once a week ___ multiple times a week

4. On average, how often did someone else engage with your child in conversation in Spanish?

___never ___a few times ___ once a week ___ multiple times a week

APPENDIX 11

OUT OF CLASS EXPOSURE PARENTAL SURVEY

Please answer the following questions regarding your child's exposure to Spanish outside of Spanish class during the duration of the course.

Participant's Name: ____

Outside Exposure

During the duration of the Spanish course:

1. On average, how often did you or someone else in the family read with your child the story books in Spanish provided by Ms. Emily? (This includes listening to the recording)

___never ___a few times ___ once a week ___ multiple times a week

2. On average, how often did your child view videos on Maestra Ibrahim's YouTube channel?

___never ___a few times ___ once a week ___ multiple times a week

3. On average, how often did your child watch, listen to, or interact with other resources in Spanish (such as videos, games, books, music, etc.)?

___never ___a few times ___ once a week ___ multiple times a week

4. On average, how often did someone else engage with your child in conversation in Spanish?

___never ___a few times ___ once a week ___ multiple times a week

APPENDIX 12

EVCBT PILOT TEST FORM

Name: ___________________________________ **Date:** ________________________

Administration: Administer all 52 items to all participants in order. Write down the response to each item and put a slash through the item number for an incorrect response. Any form of the solicited word is acceptable.

Say to the examinee: "I am going to show you some pictures and ask you a question about the picture. Answer my questions."

Use the **prompt** below each word.

1. Walking _______________________
What´s he doing?

2. Jumping _________________________
What´s he doing?

3. White _________________________
What color is the circle?

4. Drinking _________________________
What´s she doing?

5. Crying _________________________
What´s she doing?

6. Arm ___________________________
What is it? (run your finger along the arm as you ask the question)

7. Two___________________________
How many circles are there?

8. Sleeping _______________________
What´s he doing?

9. Brown_________________________
What color is the circle?

10. Dancing_______________________
What´s she doing?

11. Turtle_________________________
What is it?

12. Eating ________________________
What´s he doing?

13. Grey_______________________
What color is the circle?

14. Leg________________________
What is it? (run your finger up and down the leg)

15. Flower______________________
What is it?

16. Head_______________________
What is it? (point to the head)

17. Five___________________________
How many circles are there?

18. Listening _______________________
What´s he doing?

19. Blue __________________________
What color is the circle?

20. Nose _________________________
What is it? (point to nose)

21. Flying _________________________
What´s he doing?

22. One___________________________
How many circles are there?

23. Singing ________________________
What´s she doing?

24. House__________________________
What is it?

25. Hand __________________________
What is it?

26. Green _________________________
What color is the circle?

27. Dog ___________________________
What is it?

28. Running________________________
What´s he doing?

29. Sad ___________________________
How does he feel?

30. Pink _________________________
What color is the circle?

31. Horse _________________________
What is it?

32. Mouse _________________________
What is it?

33. Fell down_______________________
What happened?

34. Six____________________________
How many circles are there?

35. Black_ _________________________
What color is the circle?

36. Rabbit _________________________
What is it?

37. Happy__________________________
How does she feel?

38. Yellow __________________________
What color is the circle?

39. Dolphin__________________________
What is it?

40. Sitting __________________________
What´s she doing?

41. Frog ____________________________
What is it?

42. Red _____________________________
What color is the circle?

43. Four_____________________________
How many circles are there?

44. Shark ___________________________
What is it?

45. Orange__________________________
What color is the circle?

46. Monkey _________________________
What is it?

47. Fish ___________________________
What is it?

48. Three__________________________
How many circles are there?

49. Cat ____________________________
What is it?

50. Monster________________________
What is it?

51. Purple__________________________
What color is the circle?

52. Dancing________________________
What is she doing?

Total correct __________

APPENDIX 13

RVCBT PILOT TEST FORM

Name: ______________________________ **Date:** _____________________

DOB:___________________ **Age:** ___________ **Grade Completed:** ________

Administration: Administer all 56 items to all participants in order. Write down the response to each item and put a slash through the item number for an incorrect response.

Say to the examinee: "I am going to show you some pictures and say a word in Spanish. You point to the picture of the word that I say or tell me the letter of the word."

1. Sitting– C _____
2. Blue – D _____
3. Elephant – D _____
4. Walking – B _____
5. Arm – B _____
6. Green – B _____
7. Turn around – A _____
8. Monkey – B _____
9. Drinking – D _____
10. Leg – D _____
11. Black – B _____
12. Crying – C _____
13. Octopus – B _____
14. Dancing – C _____
15. White – A _____
16. Sleeping – A _____
17. Clapping – B _____
18. Cat – D _____
19. Purple – C _____
20. Listening – D _____
21. Mouth – A _____
22. Moving – B _____
23. Giraffe – C _____
24. Head – A _____
25. Horse – A _____
26. Stomach – C _____
27. Brown – B _____
28. Foot – B _____
29. Flying – A _____
30. Singing – D _____
31. Big – A _____
32. Running – C _____
33. Pink – A _____
34. Ear – C _____
35. Bird – A _____
36. Eating – B _____

37. Eye – C ______

38. Dog – C ______

39. Grey – D ______

40. Swimming – D ______

41. Scared – B ______

42. Mouse – A ______

43. Small – C ______

44. Fell down – D ______

45. Red – A ______

46. Frog – D ______

47. Sad – D ______

48. Hug – B ______

49. Get up – D ______

50. monster – B ___

51. Yellow – A ______

52. Turtle – B ______

53. Shoulder – D ______

54. Shark – C ______

55. Bicycle – D ______

56. Orange – C ______

TOTAL CORRECT: ____________

APPENDIX 14

EVCBT ASSESSMENT FORM

Name: ______________________________ **Date:** ____________________

Administration: Administer all 35 items to all participants in order. Write down the response to each item and put a slash through the item number for an incorrect response. Any form of the solicited word is acceptable.

Say to the examinee: "I am going to show you some pictures and ask you a question about the picture. I want you to tell respond to my question is *in Spanish.*"

Use the **prompt** below each word. Ask the prompt in Spanish, English and Spanish again.

1.Camina _______________________
¿Qué hace? / What´s he doing?

2. Bebe _________________________
¿Qué hace? / What´s she doing?

3. Llora _________________________
¿Qué hace? / What´s she doing?

4. Dos___________________________
¿Cuántos círculos hay? / How many circles are there?

5. Duerme _______________________
¿Qué hace? / What´s he doing?

6. Café_________________________
¿Qué color es el círculo? / What color is the circle?

7. Tortuga_________________________
¿Qué es? / What is it?

8. Come ________________________
¿Qué hace? / What´s he doing?

9. Mano _________________________
¿Qué es? / What is it?

10. Verde ________________________
¿Qué color es el círculo? / What color is

11. Perro ___________________________
¿Qué es? / What is it?

12. Cinco__________________________
¿Cuántos círculos hay? / How many circles are there?

13. Escucha ______________________
¿Qué hace? / What´s he doing?

14. Azul _________________________
¿Qué color es el círculo? / What color is the circle?

15. Nariz ________________________
¿Qué es? / What is it? (point to nose)

16. Uno___________________________
¿Cuántos círculos hay? / How many circles are there?

17. Canta ________________________
¿Qué hace? / What´s she doing?

18. Se sienta_______________________
¿Qué hace? / What´s she doing?

19. Rana____________________________
¿Qué es? / What is it?

the circle?

20. Rojo ___________________________
¿Qué color es el círculo? / What color is the circle?

21. Cuatro__________________________
¿Cuántos círculos hay? / How many circles are there?

22. Tiburón_________________________
¿Qué es? / What is it?

23. Corre__________________________
¿Qué hace? / What´s he doing?

24. Triste__________________________
¿Cómo se siente? / How does he feel?

25. Rosa ________________________
¿Qué color es el círculo? / What color is the circle?

26. Caballo ________________________
¿Qué es? / What is it?

27. Seis___________________________
¿Cuántos círculos hay? / How many circles are there?

28. Negro_________________________
¿Qué color es el círculo? / What color is the circle?

29. Feliz___________________________
¿Cómo se siente? / How does he feel?

30. Amarillo ________________________
¿Qué color es el círculo? / What color is the circle?

31. Anaranjado______________________
¿Qué color es el círculo? / What color is the circle?

32. Pez ___________________________
¿Qué es? / What is it?

33. Tres__________________________
¿Cuántos círculos hay? / How many circles are there?

34. Gato___________________________
¿Qué es? / What is it?

35. Morado_________________________
¿Qué color es el círculo? / What color is the circle?

Total correct __________

.

APPENDIX 15

RVCBT ASSESSMENT FORM

Name: ________________________________ **Date:** ______________________

DOB:____________________ **Age:** ____________ **Grade Completed:** ________

Administration: Administer all 45 items to all participants in order. Write down the response to each item and put a slash through the item number for an incorrect response.

Say to the examinee: "I am going to show you some pictures and say a word in Spanish. You point to the picture of the word that I say or tell me the letter of the word."

1. Se sienta– C _____
2. Azul – D _____
3. Elefante – D _____
4. Camina – B _____
5. Brazo – B _____
6. Verde – B _____
7. mono – B _____
8. bebe – D _____
9. pierna – D _____
10. negro – B _____
11. llora – C _____
12. baila – C _____
13. blanco – A _____
14. duerme – A _____
15. gato – D _____
17. escucha – D _____
18. boca – A _____
19. cabeza – A _____
20. caballo – A _____
21. café – B _____
22. pie – B _____
23. canta – D _____
24. grande – A _____
25. corre – C _____
26. rosa – A _____
27. oreja – C _____
28. come – B _____
29. ojo – C _____
30. perro – C _____
31. gris – D _____

16. morado – C ______

33. tiene miedo – B ______

34. pequeño – C ______

35. rojo – A ______

36. rana – D ______

37. triste – D ______

38. abrazo – B ______

39. se levanta – D ______

32. nada – D ______

40. monstruo – B ___

41. amarillo – A ______

42. tortuga – B ______

43. hombro – D ______

44. tiburón – C ______

45. anaranjado – C ______

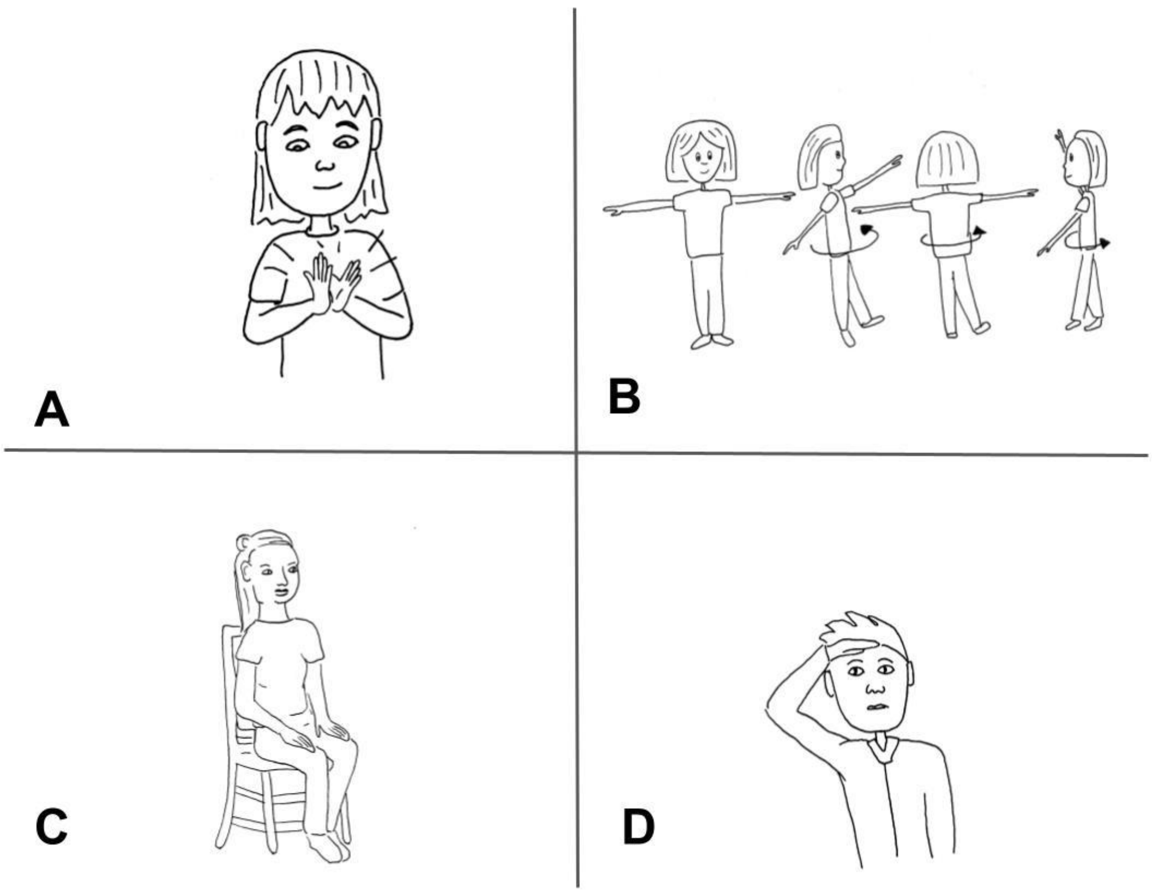
TOTAL CORRECT: ___________

APPENDIX 16

EVCBT ITEM SAMPLE

APPENDIX 17

RVCBT ITEM SAMPLE



APPENDIX 18

INTERVENTION PARTICIPANT INFORMATION

Table A1. Intervention participant background information

Intervention Participant	Age	Gender	Grade Completed	NVMA	NVC Raw Score	Summer Camp Class	Hearing Status
DS1	6:9	F	K	<4:0	7	Middle	Normal
DS2	7:5	M	1	<4:0	9	Lower	Normal
DS3	8:2	M	1	<4:0	9	Middle	Normal
DS4	9:4	F	2	<4:0	6	Middle	Normal
DS5	10:4	F	3	<4:0	4	Upper	Normal
DS6	10:10	M	4	<4:0	10	Upper	Normal
DS7	11:6	M	4	5:8	18	Upper	Normal
DS8	12:0	F	5	4:8	13	Upper	ML-NC
DS9	12:6	F	4	5:6	17	Upper	Normal
DS10	12:8	M	6	5:8	18	Upper	Normal
DD1	9:5	M	3	<4:0	2	Middle	Normal
DD2	9:6	M	2	<4:0	4	Middle	ML-NC
DD3	9:7	F	2	<4:0	3	Middle	Normal

NOTE: DS = Down syndrome; DD = dual diagnosis; Age (years:months); NVMA = nonverbal mental age (years:months); NVC = nonverbal cognition; ML-NC = mild loss, no correction

Table A2. Intervention participant pre-intervention assessment results

Intervention Participant	KBIT-2 RS	EVT-2 RS	PPVT-4 RS	NWRT T/16
DS1	7	40	37	7
DS2	9	64	73	8
DS3	9	0	36	0
DS4	6	43	41	0
DS5	4	54	46	0
DS6	10	80	103	12
DS7	18	66	104	13
DS8	13	68	87	9
DS9	17	73	81	7
DS10	18	10	64	0
DSOG	*M* 11.1 *SD* 5.13	*M* 49.8 *SD* 26.81	*M* 67.2 *SD* 26.42	*M* 5.6 *SD* 5.19
DD1	2	0	39	0
DD2	4	10	40	3
DD3	3	0	34	0

NOTE: DS = Down syndrome; DSOG = Down syndrome only group; DD = dual diagnosis; RS = raw score; NWRT = non-word repetition task; T/16 = total out of 16

Table A3. Intervention participant post-intervention assessment results

Inter Par	EVT-2 RS	PPVT-4 RS	EOWPVT-B T/34	ROWPVT-B T/34	EVCBT T/35	RVCBT T/45
DS1	38	19	1	12	11	31
DS2	78	87	1	10	15	22
DS3	0	56	0	4	0	23
DS4	51	57	4	7	19	35
DS5	41	32	0	8	1	9
DS6	85	89	2	13	17	34
DS7	73	104	1	13	15	34
DS8	82	89	5	13	27	41
DS9	78	96	5	9	21	30
DS10	7	82	0	11	0	19
DSOG	*M* 53.3 *SD* 31.29	*M* 71.1 *SD* 28.65	*M* 1.9 *SD* 2.02	*M* 10 *SD* 3.02	*M* 12.6 *SD* 9.45	*M* 27.8 *SD* 9.46
DD1	0	23	0	11	0	28
DD2	23	46	0	13	1	15
DD3	0	23	0	10	0	23

NOTE: Inter Par = intervention participant; DS = Down syndrome; DSOG = Down syndrome only group; DD = dual diagnosis; RS = raw score; T/ = total out of

Table A4. Dual diagnosis *t*-test comparisons

PAR	ASSESS	Raw Score	*t*	*p*	Point Estimate (CI)	Effect Size (CI)
DS CG (*n*=10)	EOWPVT	*M* 1.9 *SD* 2.02	—	—	—	—
DD1	EOWPVT	0	-0.895	0.394	19.71 (4.71 to 43.31)	-0.94 (-1.67 to -0.17)
DD2	EOWPVT	0	-0.895	0.394	19.71 (4.71 to 43.31)	-0.94 (-1.67 to -0.17)
DD3	EOWPVT	0	-0.895	0.394	19.71 (4.71 to 43.31)	-0.94 (-1.67 to -0.17)
DS CG (*n*=10)	EVCBT	*M* 12.6 *SD* 9.45	—	—	—	—
DD1	EVCBT	0	-1.271	0.236	11.78 (1.46 to 32.72)	-1.33 (-2.18 to -0.45)
DD2	EVCBT	1	-1.170	0.272	13.60 (2.05 to 35.39)	-1.23 (-2.04 to -0.38)
DD3	EVCBT	0	-1.271	0.236	11.78 (1.46 to 32.72)	-1.33 (-2.18 to -0.45)
DS CG (*n*=10)	ROWPVT	*M* 10 *SD* 3.02	—	—	—	—
DD1	ROWPVT	11	0.316	0.759	62.04 (37.63 to 83.16)	0.33 (-0.32 to 0.96)
DD2	ROWPVT	13	0.948	0.368	81.60 (58.28 to 95.94)	0.99 (0.21 to 1.74)
DD3	ROWPVT	10	0.000	1.000	50.00 (26.77 to 73.23)	0.00 (-0.62 to 0.62)
DS CG (*n*=10)	RVCBT	*M* 27.8 *SD* 9.46	—	—	—	—
DD1	RVCBT	28	0.020	0.984	50.78 (27.45 to 73.91)	0.02 (-0.60 to 0.64)
DD2	RVCBT	15	-1.290	0.229	11.46 (1.36 to 32.22)	-1.35 (-2.21 to -0.46)
DD3	RVCBT	23	-0.484	0.640	32.01 (12.37 to 56.60)	-0.51 (-1.16 to 0.17)

NOTE: PAR = participant; DS = Down syndrome; DS CG = DS control group; DD = dual diagnosis; ASSESS = assessment; *p* = two-tailed probability; Point estimate = percentage of the control population estimated to perform below the case's score; CI = 95% confidence interval

Table A5. Intervention participant
GSV difference

Intervention Participant	EVT-2 GSV DIF	PPVT-4 GSV DIF
DS1	-2	-15*
DS2	10*	9*
DS3	0	18*
DS4	6	14*
DS5	-11*	-10*
DS6	2	-11*
DS7	4	-1
DS8	9*	0
DS9	3	10*
DS10	-4	12*
DD1	0	-12*
DD2	18*	7
DD3	0	-7

NOTE: DS = Down syndrome; DD = dual diagnosis GSV DIF = growth scale value difference from pre- to post-intervention; * = statistically significant difference (p<.10)

APPENDIX 19

PILOT TEST PARTICIPANT INFORMATION

Table A6. Pilot test participant background information

Participant	Age	Grade Completed	Language	Expressive Administered	Receptive Administered
TD1	11	5	English	Yes	Yes
TD2	11	5	English	Yes	Yes
TD3	11	5	English	Yes	Yes
TD4	11	5	English	Yes	Yes
TD5	10	4	English	Yes	Yes
TD6	9	3	English	Yes	Yes
TD7	9	3	English	Yes	Yes
TD8	8	2	English	Yes	Yes
TD9	7	1	English	Yes	Yes
TD10	7	1	English	Yes	Yes
TD11	7	1	English	Yes	Yes
TD12	7	1	English	Yes	Yes
TD13	6	K	English	Yes	Yes
DS1	8	1	English	Yes	Yes
DS2	10	3	English	Yes	Yes
DS3	10	4	Spanish	No	Yes
DS4	10	4	English	Yes	Yes
DS5	12	5	English	Yes	Yes

APPENDIX 20

CASE STUDY LANGUAGE PROFILES

Table A7. Case study participant language profiles

	Allen	Sammy	Grace	Rusty	Rosie
PPVT-4 PRE-I					
Raw	73	40	34	104	87
Age eq.	4:7	2:11	2:4	6:4	5:5
GSV	123	96	90	144	133
EVT-2 PRE-I					
Raw	64	10	NA	66	68
Age eq.	5:2	NG	—	5:4	5:6
GSV	138	85	—	140	141
NWRT	8	3	NA	13	9
PPVT-4 POST-I					
Raw	87	46	23	104	89
Age eq.	5:3	3:4	2:4	6:3	5:5
GSV	132	103	83	143	133
GSV DIF	9*	7	-7	-1	0
EVT-2 POST-I					
Raw	78	23	NA	73	82
Age eq.	6:1	2:4	—	5:9	6:5
GSV	148	103	—	144	150
GSV DIF	10*	18*	—	4	9*
EWOPVT-B	1	0	NA	1	5
RWOPVT-B	10	13	10	13	13
EVCBT	15	1	NA	15	27
RVCBT	22	15	23	34	41

NOTE: PRE-I = pre-intervention; POST-I = post intervention; Age eq. = age-equivalent (years:months); GSV = growth scale value; DIF = difference; * = statistically significant (*p*<.10); NG = none given; NA = not administered

APPENDIX 21

VARIABLE MEANS AND STANDARD DEVIATIONS

Table A8. Variable means and standard deviations

Variable	*M*	*SD*
Chronological Age MO	121.6	25.9
Nonverbal cognition RS	11.1	5.13
L1 Expressive RS	49.8	26.81
L1 Receptive RS	67.2	26.42
Nonword repetition task T/16	5.6	5.19
Class Attendance T/30	27.7	2.54
Outside Exposure S/O 0–3	1.6	0.97
Maternal Education S/O 1–5	3.3	1.16

NOTE: MO = months; RS = raw score; T/ = total out of;
S/O = scale of

APPENDIX 22

VARIABLE CORRELATIONS

Table A9. Pearson *r*-correlations to Spanish acquisition

	EVCBT	EOWPVT	RVCBT	ROWPVT
CA				
r(8)	0.22	0.37	0.14	0.34
p	0.275	0.145	0.348	0.167
NVC				
r(8)	0.18	0.18	0.27	0.42
p	0.308	0.307	0.223	0.116
L1 Exp				
r(8)	0.75	0.53	0.41	0.58
p	0.006*	0.056**	0.122	0.039*
L1 Rec				
r(8)	0.54	0.31	0.44	0.71
p	0.052*	0.195	0.099	0.011*
NWRT				
r(8)	0.64	0.27	0.6	0.77
p	0.024*	0.225	0.033*	0.004*
Class Att				
r(8)	-0.42	-0.16	-0.26	-0.28
p	0.112	0.332	0.237	0.221
OE				
r(8)	0.18	-0.14	0.04	0.38
p	0.314	0.354	0.458	0.139
ME				
r(8)	0.66	0.63	0.48	0.16
p	0.019*	0.026*	0.079	0.331

NOTE: CA = chronological age; NVC = nonverbal cognition; L1 Exp = L1 expressive (EVT-2); L1 Rec = L1 receptive (PPVT-4); NWRT = nonword repetition task; Class Att = class attendance; OE = outside exposure; ME = maternal education; * = statistical significance (*p*=.05); ** = approaching significance

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ABSTRACT

FOREIGN LANGUAGE ACQUISITION AMONG CHILDREN
WITH DOWN SYNDROME: A PRECEDENT STUDY
FOR CHRISTIAN SCHOOLS

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Children with Down syndrome (DS) are largely excluded from the foreign language (FL) classroom, and no research exists documenting their abilities to learn a FL. Research is needed to demonstrate the abilities of children with DS to learn a FL so that they might be included in the FL classroom along with their typically developing peers and be afforded the same benefits of learning a second language. This exploratory mixed methods multiple case study is the first to document the participation of elementary-aged children with DS with and without a comorbid diagnosis of autism in a FL class and to measure the receptive and expressive lexical acquisition of Spanish as a FL in students with DS. In the first phase, students underwent a six-week Spanish intervention. In the second phase, vocabulary assessments based off of the Spanish intervention curriculum were developed, and in the third phase, participants were assessed on their expressive and receptive Spanish vocabulary using standardized assessments and the instrumentation developed in stage 2. All students demonstrated measurable evidence of Spanish vocabulary acquisition, with receptive acquisition exceeding expressive, and exposure to a FL did not appear to impact L1 vocabulary development. Students with a dual diagnosis of autism did not differ significantly from their peers with DS only in acquisition. Additionally, L1 receptive ability, performance on a nonword repetition task, maternal education, and L1 expressive ability were found to significantly correlate with FL acquisition. Finally, the qualitative and quantitative data was combined to provide an overall language acquisition profile of each child who participated in the multiple case study. Implications for children with DS, FL teachers, school administrators and other professionals, and Christian schools are discussed.

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